THE
ASIATIC SOCIETY OF BOMBAY
Town Hall, Bombay

00110203

ENGINEERS' REPORT

FOR THE

YEAR 1846-47.

1846-52.

110203

Bombay:

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Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	7,603	5	1	23,946	10	2
Repairing dungaree ceiling of three Officers' Quarters and part of the bamboo wall in the Sanatarium on the Esplanade	40	0	0			
Repairing the Ordnance Bunder	87	0	0			
Repairing the drain passage through the compound of the Adjutant of the Marine Battalion	59	0	0			
Repairing the outer tattas of the necessaries used by the women of the 20th Regiment Native Infantry	3	0	0			
Constructing drains to the compound and foot-paths to the out-offices of the Brigade Hospital on the Esplanade	250	4	0			
White-washing the Barracks at Colaba	106	0	0			
Making minor improvements and alterations to the Hospitals at the Presidency	7,200	0	0			
Rebuilding the wall on both sides of the entrance to the packing room in the Grand Arsenal	750	0	0			
Fitting up the places at the entrance of the offices and new Quarters both in the Town Barracks and Fort George	92	0	0			
Repairing the Godowns in the Mandavee Lunette, in charge of the Deputy Commissary General	32	0	0			
Making mat veranda and glass casement to the South and West verandas of the Adjutant's Quarters, 23rd Regiment N. L. I. at Bore Bunder	260	0	0			
Repairing a wooden trough of the European General Hospital	9	5	0			
Repairing the wall round the compound of No. 32 Bungalow at Colaba	5	12	0			
Making four additional windows to the packing room in the Arsenal &c.	136	0	0			
Renewing the ceiling of the bedroom of No. 56 Quarters at Colaba	24	0	0			
Putting a railing round the Ditch from the outer Gate to the Officers' Mess House in Fort George	290	0	0			
Filling in the space of ground in the Gun Carriage yard at Colaba	240	0	0			
Substituting Pore Bunder stone floor for the present one of chunam in the Billiard Table Veranda in the Mess House, and rebuilding the privy and fitting it up with a water-closet at Colaba	265	0	0			
Preserving the mat frames removed from the Barracks at Colaba	18	6	10			
Repairing the gates of the Fire Engine shed	5	4	6			
Repairing the railing and gates &c. of the Lines of the 24th Regiment Native Infantry	109	0	0			
Constructing additional cook-house accommodation for the Hospital used by the regiment quartered at Colaba, and the Depôt Queen's Troops	1,360	0	0			
Making alterations in the Gun Carriage Manufactory at Colaba	87	0	0			
Repairing the gate leading to the Town Barrack, and replacing to top stone of the drain in the square &c.	13	0	0			
Carried forward Rs....	19,045	5	5	23,946	10	2

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs	a.	p.	Rs	a.	p.
Brought over Rs....	19,045	5	5	23,946	10	2
Making a weather frame to the Town Major's office	20	0	0			
Making repairs to Bungalow No. 106 at Colabah	2	8	0			
Replacing the wooden post of veranda of the Gun Shed in Fort George	12	0	0			
Converting the Northern end of the veranda of the Town Major's office into a small room by trellis work	87	0	0			
Making repairs to the railings and one of the Gateways of the Marine Battalion Lines	21	0	0			
Repairing the Door of the Sally Port leading from Fort George towards Boree Bunder	6	0	0			
Making alterations and additions to the Commissariat shed for Bullocks and Carts in Mody Bay	301	0	0			
Putting up a punkah in the office of the Deputy Adjutant General, Her Majesty's Forces	26	0	0			
				19,515	13	5
Buildings.						
Putting an upper story on the petty store room in the Grand Arsenal	2,906	8	0			
Erecting a Guard room in the Church Gate Ravelin	530	0	0			
Erecting a work shed and store room in the Cooperage, making an office &c	1,422	0	0			
Constructing a carriage road from the Castle Gate to the Mint Tank	266	0	0			
Erecting a Privy for the use of the Serjeant at the Saluting Battery	28	8	0			
Enclosing and recovering from the Sea a portion of ground adjoining the Gun Carriage premises on Colaba	2,475	0	0			
Erecting solitary cells for the European troops in Garrison	4,740	0	0			
Erecting solitary cells for the European troops at Colaba	4,980	0	0			
Erecting three pendalls for 2nd class servants to the Native Infantry Hospital on the Esplanade	697	0	0			
Erecting a pendall for the servants of the Hospital for the European Regiment at Colaba	1,800	0	0			
Erecting a shed for the reception of the Commissariat Bullocks and Carts, near the Town Barracks	2,080	0	0			
Constructing a wall of rubble masonry round the tank in Fort George	296	0	0			
Purchasing kutcha sag planks required to form a road-way for a bridge of Boats for the Engineer Department in Scinde	780	2	4			
Erecting a Guard-room outside the Gate of the camp-equipage yard in the Grand Arsenal	295	0	0			
Purchasing rafters for Barracks to be erected at Hydrabad in Scinde	559	2	6			
Erecting a shed on the Esplanade for giving cover to the wood work for the Hydrabad Barracks	269	0	0			
Purchasing Bamboos required for the Ex-Engineer's Department at Aden	1,075	2	4			
Repairing doors, teakwood, for the completion of the Hospital and out-houses of the new European Barracks at Hydrabad in Scinde	1,931	0	0			
Carried forward Rs..	27,130	7	2	43,462	7	7

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	27,130	7	2	43,462	7	7
Hammallage and boat hire for conveying doors to Kurrachee, for the completion of the Hospital and out-houses of the new European Barracks at Hydrabad in Scinde.....	46	15	9			
Supplying wood and iron works for ten Barracks to be erected at Hydrabad in Scinde.....	62,316	0	0			
Erecting a Guard room and privy in the Gun Carriage Manufactory at Colaba.....	1,950	0	0			
Hammallage and boat hire &c. for conveying the wood and iron works of the Barracks to Hydrabad in Scinde.	2,998	3	8			
Removing the Warrant Officer's Quarters at Colaba, and erecting new Quarters in their stead.....	4,400	0	0			
				98,849	10	7
Levelling the Esplanade, constructing flat rooms &c. for Dhobees, and the Establishment for collecting the Esplanade fees.....				9,330	1	4
Grand Total, Rupees one Lac, fifty one thousand, six hundred and forty two, annas three, and pies six.....				1,51,642	3	6

Statement of the sums expended by the Garrison Engineer at the Presidency, from 1st May 1846 to 30th April 1847.

Name of Officer.	Annual and special repairs.			Certain Works.			Building.			Expended from Esplanade Fund.			Total.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Captain T. M. B. Turner, Garrison Engineer.....	23,946	10	2	19,515	13	5	98,849	10	7	9,330	1	4	1,51,642	3	6

Statement shewing the cost of Engineering and General Superintendence of the Garrison Engineer's Department for the above period.

Name of Officer.	Expense of Establishment per annum.			Expenditure.			Rate per cent.
	Rs.	a.	p.	Rs.	a.	p.	
Captain T. M. B. Turner, Garrison Engineer at the Presidency.....	13,263	12	9	1,51,642	3	6	8¾

Statement of sums expended, not included in the above statement, on account of workmen and materials forwarded to Out-Stations.

	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
To amount paid to artificers proceeding to, or returning from, out-stations &c.....	41,503	7	9			
To amount paid for materials forwarded to Scinde.....	2500	0	0			
				44,003	7	9
Total, Rupees forty-four thousand and three, annas seven, and pies nine..				44,003	7	9

(Signed) H. J. WILLOUGHBY, Capt.
Acting Garrison Engineer at the Presidency.

No. 218 of 1847.

GENERAL DEPARTMENT.

Civil Architect's Office.

Bombay 24th July 1847.

SIR,

1. Agreeably to the instructions contained in your circular letters No. 4395 of the 11th November 1843, and No. 3316 of the 18th August 1845, I have the honor to enclose a statement of the expenditure of my Department during the past official year, drawn up in the prescribed form.

2. In the statement shewing the expense of Engineering and Superintendence I have entered the staff allowances of the Civil Architect and the cost of Establishment of every kind, which shews the charge for Engineering &c. to be 12 per cent. on the outlay.

3. As almost the whole of the works are executed by contract, I am unable to afford any data deduced from actual experience regarding the expense of labour or materials of any portion of a work.

I have the honor to be, &c.

(Signed) H. J. WILLOUGHBY, Capt.

Acting Civil Architect at the Presidency.

(True Copy.)

(Signed) N. H. THORNBURY, Capt.

Secretary Military Board.

TO THE SECRETARY TO THE MILITARY BOARD,

BOMBAY.

Account of the Expenditure in the Civil Architect's Department for the year 1846 | 47.

Bombay, 1st May 1847.

Name of Works.	Amount.			Total.		
General Department.	Rs.	a.	p.	Rs.	a.	p.
Annual and Special Repairs.						
Annual and special repairs to the buildings in the General Department for 1846	14,809	10	9	14,809	10	9
Certain Works.						
Substituting plank ceiling for the present one of cloth in the Roman Catholic Church at Colaba	274	0	0			
Making alterations to the Lunatic Asylum at Colaba	7,775	0	0			
Making alterations to the General Post Office	470	0	0			
Putting glass casements to the veranda and windows of the office of the Hon'ble Company's Solicitor	400	0	0			
Cleaning out the Phansi Tank on the Esplanade	185	0	0			
Putting up a water-closet in Mr. Secretary Escombe's office	349	8	0			
Cleaning out the Town Hall enclosure	24	0	0			
Cow-dunging the floors of the Post Office	16	0	0			
Repairing wooden posts and iron chain on the Bombay Green	0	13	10			
Making four openings within the railing between the Church and Apollo Gate	295	0	0			
Removing the remains of the old ramps of Phansi Tank on the Esplanade	900	0	0			
Putting up a new ceiling in the office of the Hon'ble Company's Solicitor	104	0	0			
Executing certain repairs to the different wells on the Esplanade	126	0	0			
Putting up a temporary dam to prevent the sea water flowing into the spring in the Colaba channel	97	13	10			
Adjusting the displaced stones of the Apollo Pier and Colaba Causeway	31	11	2			
Securing from further damage the wall of the Burial ground at Back Bay	328	1	5			
Rebuilding portion of the wall of the compound of Parell Government House, which has been thrown down by the rain water	73	0	0			
Repairing the out-houses of the Observatory, damaged by the Monsoon	9	0	0			
Repairing two side slopes of the Colaba Causeway	65	0	0			
Repairing a venetian window in the office of Superintendent of Stationery	9	0	0			
Making additions and repairs required to the Burial Ground at Back Bay	3,864	0	0			
Fixing a weather board to a window of a room on the ground floor of Parell Government House, appropriated as an office, for the purpose of keeping out the rain	50	0	0			
Repairing the roof of the Cow House and Buffaloes' shed at Parell	48	0	0			
Carried forward Rs.	15,482	0	3	14,809	10	9

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs..	15,482	0	3	14,809	10	9
Repairing broken panes of glass in the Serjeant's Quarters and chowkey attached to the Pound	10	11	0			
Making the necessary repairs to the Southern Veranda of the sleeping Bungalow at Malabar Point, damaged by the late high winds	13	8	0			
Repairing the weather frames of the Secretariate Premises, blown down by the late high winds	8	0	0			
Exchanging the brass bolts at present fastening the several doors of the basement room of the Town Hall, as also two door locks	9	8	0			
Putting up a plank ceiling to and paving the floors of the General Post Office	4,470	0	0			
Repairing posts and iron chain on the Bombay Green	17	6	0			
Removing the stuccoed ceiling of the large Hall of the Secretariate and substituting a cloth one	221	0	0			
Lessening the depth of the bathing pool at the Lunatic Asylum at Colaba	10	0	0			
Reconstructing a portion of the front wall of the office of the Hon'ble Company's Solicitor	91	0	0			
Making the venetian window in the Hon'ble the Governor's bathing room at Parell	27	0	0			
Putting up two plank screens in the Lunatic Asylum at Colaba	20	0	0			
Making three punkahs, two bathing places, and a new mouthpiece for the principal fountain in front of Government House at Parell	263	0	0			
Repairing two lamp posts at the Government House at Parell	19	0	0			
Raising the lintil of a door and converting the five stalls into loose boxes of the principal stable at Parell	337	7	6			
Making alterations and additions to the Jamsetjee Jeejeebhoy Hospital	500	0	0			
White-washing inside the Jamsetjee Jeejeebhoy Hospital	112	0	0			
Watchman in the Civil Architect's yard, and behind the Town Barracks	84	12	5			
Conveyance for Maistree to superintend the civil works	240	0	0			
Additional temporary assistance required in the Civil Architect's Office	411	8	0			
				22,360	13	2
Buildings.						
Erecting a Dhurmsalla for the use of the destitute poor of the Island of Bombay, in connexion with the District Benevolent Society	32,247	0	0			
Improving the communication between the Fort and Esplanade at the Apollo Gate	13,373	12	0			
Excavating four old additional wells on the Esplanade	100	0	0			
Constructing a road from the Boree Bunder Custom House Chowkey to the main road	590	0	0			
Carried forward Rs....	46,310	12	0	37,170	7	11

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	46,310	12	0	37,170	7	11
Constructing right portion of Jamsetjee Jeejeebhoy Hospital...	126	0	0			
Constructing compound gates, enclosure wall, and railing for Jamsetjee Jeejeebhoy Hospital..	500	0	0			
Making roads within the compound of the Grant Medical College and Jamsetjee Jeejeebhoy Hospital..	240	0	0			
Making fittings &c. for the Grant Medical College....	117	13	0			
Making up two carts for removing the sweepings &c. of the Jamsetjee Jeejeebhoy Hospital....	274	15	1			
Levelling the ground generally within the compound of Grant Medical College and Jamsetjee Jeejeebhoy Hospital	522	5	11			
Erecting two Pendalls for the thirty-nine second class Hospital servants attached to the Jamsetjee Jeejeebhoy Hospital..	1,225	0	0			
				49,316	14	0
Judicial Department.						
Annual and Special Repairs.						
Annual and special repairs to the buildings in the Judicial Department for 1846.....	3,450	7	10			
				3,450	7	10
Certain Works.						
Making certain improvements and alterations in the House of Correction.....	3,193	0	0			
Making alterations and improvements in the House of Correction.....	800	0	0			
White painting the Chambers of the Hon'ble Sir Erskine Perry in the Supreme Court.....	163	0	0			
Cleaning and oiling the ceiling of the trial wards in the Jail.	40	0	10			
Preparing a scaffold and all other things, for a native named Rugoonath Muddon, sentenced by the Supreme Court to be executed.....	12	10	10			
Putting a screen over a portion of the new Tread Mill in the County Jail.....	198	0	0			
Boxing in the ends of the Tread Mill now in use at the County Jail.....	30	0	6			
Repairing a broken wheel of the Tread Mill in the County Jail.....	9	4	9			
Half yearly white and grey-washing the interior of the County Jail.....	130	0	0			
Preparing a scaffold and all other things, for a native named Pestonjee Jamsetjee, sentenced by the Supreme Court to be executed.....	11	3	2			
				4,587	4	1
Buildings.						
Erecting an Iron Tread Mill in the County Jail.....	100	0	0			
Constructing a cart with Iron Tank for the use of the House of Correction, similar to those in use at the Byculla Schools.....	136	13	0			
Carried forward Rs....	236	13	0	94,525	1	10

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs.....	236	13	0	94,525	1	10
Erecting an iron Tread Mill in the House of Correction at Byculla.....	1,823	0	0			
				2,059	13	0
Territorial Department.						
Annual and Special Repairs.						
Annual and special repairs to the buildings in the Territorial Department for 1846....	7,631	10	0			
				7,631	10	0
Certain Works.						
Making one new iron-barred window, and lengthening the lower part of the two present windows, and white-washing walls and ceiling in the Inspectors' office of the Custom House in the Fort.....	50	0	0			
Making repairs to a Bungalow and 5 Chowkies lately made over by the farmer of salt pans to the Department of the Collector of Land Revenue.....	162	0	0			
Repairing the dry stone retaining wall at the Boree Bunder, and the Masonry wall near Cooly Bunder, injured by the late gale and high tides.....	94	0	0			
Levelling and draining of the Town Custom House wharf and inner Court yard.....	20	0	0			
Making certain alterations to the General Treasury....	200	0	0			
Making additions to the wall and constructing a gate at Cooly Bunder.....	474	0	0			
Removing and re-constructing the Custom Chowkey at Mazagon Bunder.....	226	0	0			
Removing certain posts and rails in the Town Custom House wharf, and making and fixing new rails in other places.....	770	0	0			
Removing and re-erecting the Custom Chowkey at Coolee Bunder, and for securing from the effect of the Sea the Custom House Chowkey at Sonapoor.....	370	0	0			
				2,366	0	0
Buildings.						
Erecting a covered pathway across the open Court yard between the office of the Collector of Land Revenue and the Custom House; and for drawing off the water that usually collects there during the Monsoon....	455	0	0			
				455	0	0
Carried forward Rs....				1,07,037	8	10

Expenditure.—(Continued.)

Name of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	.....	..	..	1,07,037	8	10
Marine Department.						
Annual and Special Repairs.						
Annual and special repairs to the Buildings in the Marine Department for 1846.....	3,039	0	0	3,039	0	0
Certain Works.						
Raising the drain which runs between the two ranges of Carpenters' Barracks in Tod Lane, to the level of the drain running down Tod Street.....	52	0	0			
Executing repairs to the cooking places of the Admiral's establishment.....	19	0	0			
Pulling down the Naval Captains' Bungalow with compound and out-offices on the Esplanade, and re-erecting them after the rains.....	1,100	0	0			
Removing the Admiral's Bungalow with compound and out-houses on the Esplanade.....	129	0	0			
Making repairs to the Colaba coal shed.....	15	0	0			
Repairing pulleys and other parts of the dropping board in the Astronomical Observatory at Colaba.....	9	12	6			
Paving certain passages adjoining the Artificers' Barracks in Tod Lane.....	151	15	5			
Repairing the wall of the Coal shed at Upper Colaba.....	30	0	0			
Re-erecting the Admiral's Bungalow on the Esplanade....	1,541	0	0			
Replacing the large stones at the lower part of Colaba Pilot station Bunder.....	34	0	0			
Making repairs to the dropping board apparatus at the Observatory.....	6	0	0			
Placing a post under one of the flooring beams in the Artificers' Barracks in Tod Lane.....	2	0	0			
Repairing the cock of the water pipe lately broken on the Commercial Bunder pier, and cleaning and repairing the drain.....	71	12	8			
Making repairs to the Mazagon Bunder.....	189	2	1			
Conveyance for maistree to superintend the Marine works..	240	0	0			
Additional temporary assistance required in the Civil Architect's office.....	180	0	0			
				3,770	10	8
Buildings.						
Constructing the buildings for a residence for the Naval Dubash, on the Esplanade.....	847	0	0			
				847	0	0
Grand Total, Rupees one Lac, fourteen thousand, six hundred and ninety-four, annas three, and pies six....	.....	..	..	1,14,694	3	6

Statement of the sums expended by the Civil Architect at the Presidency, from 1st May 1846 to 30th April 1847.

Name of Officer.	Annual and special repairs.			Certain Works.			Buildings.			Total.		
Captain T. M. B. Turner, Civil Architect.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
General Department	14,809	10	9	22,360	13	2	49,316	14	0	86,487	5	11
Judicial Department	3,450	7	10	4,587	4	1	2,059	13	0	10,097	8	11
Territorial Department	7,631	10	0	2,366	6	0	455	0	0	10,452	10	0
Marine Department	3,039	0	0	3,770	10	8	847	0	0	7,656	10	8
Grand Total	28,930	12	7	33,084	11	11	52,678	11	0	1,14,694	3	6

Statement shewing the cost of Engineering and General Superintendance of the Civil Architect's Department for the above period.

Name of Officer.	Expence of Establishment per annum.			Expenditure.			Rate per cent.
	Rs.	a.	p.	Rs.	a.	p.	
Captain T. M. B. Turner, Civil Architect at the Presidency	13,786	0	0	1,14,694	0	0	12

(Signed) H. J. WILLOUGHBY, Capt.
Acting Civil Architect at the Presidency.

No. 86 of 1847.

MARINE DEPARTMENT.

To

THE SECRETARY TO THE MILITARY BOARD.

SIR,

1. I have the honor now to lay before you the Transactions of this Department during the past official year.

2. The annexed statement No. I. shews the works which were in hand, and the expenditure upon each.

3. The charge for Engineering has amounted to 13¾ per cent. upon the outlay.

4. The only works of importance which I shall notice, are the widening the entrance of the Stern Duncan Dock, and the improvement to the Apollo Pier.

5. The Duncan Dock was completed shortly before the commencement of the monsoon, and every exertion was made to remove the Cofferdam to admit of the large steamers being docked, if necessary, as soon after the commencement of the monsoon as possible. The removal of the Cofferdam was effected in the following manner: previous to the admission of any water through it, the Cofferdam was supported inside by extra shores, which could easily be taken up, and every portion of the clay puddling between it and the gates excavated up to the gate piles—the Dock gates being closed to prevent any water entering the Dock. The two lower wale-pieces of the Dam were then cut out, as well as all the lower bolts, and a considerable portion of the puddling both inside and outside the Dam cleared out. The Dam now began to leak so much that I directed its penstock to

be opened to admit the water through it, and its functions as a Dam here ceased. During the ensuing two spring tides the excavation of the clay puddling was continued, and all the wales and bolts were removed. The piles were now ready to be drawn, and I started the first by means of two screw-jacks applied on either side of a wooden frame, bolted to the top of the pile, which after great exertion was drawn. I also extracted some others by this means, as well as by means of a long heavy spar used as a lever, the fulcrum being within two feet of the pile. These means however were found too slow, and the Master Attendant's Department put up for me two pairs of large shears, the falls of which were led to the capstans on either side of the Dock, by which means the piles were easily and rapidly drawn within a very few days. The Dredging Boat was then set to work, and all the accumulation of mud which had taken place in the channel since the Docks were closed, speedily removed. The Docks were now ready for the admission of vessels, and the P. & O. Company's Steamer "Braganza" was the first vessel docked.

6. The Dock gates have been found to work easily and well, and to be quite water tight.

7. The new penstocks have likewise been found to answer well, having this advantage over the old scuttles, that the water can be admitted rapidly into the Dock at any time, and as much or as little as may be required.

8. The "improvements to the Apollo Pier" were commenced in the month of September last, and completed in June.

9. This work was called for in consequence of the old rubble stone slope at the end of the pier being nearly every monsoon so damaged, as to render it impassable till repaired. The present work has been built upon the base of the old rubble stone slope, commencing from low water mark spring tides. This slope, which has been built for years, it was considered would bear the additional weight of the new work without much settlement; to have weighted it would have put the public to so much inconvenience, that it was out of the question. When the new work, which from its base has been carefully brought up in complete courses (including the filling in), had reached the height of about ten feet, a slight settlement was apparent; this increased till the work reached a height of about eighteen feet, when it began to diminish, and by the time the work had reached its full height it had very nearly ceased alto-

gether. Since the completion of the work, the settlement has been so trifling as to be scarcely worthy of notice, and I feel satisfied now, that if it settles at all, half an inch will be its utmost extent.

10. I have alluded to the above solely as a guide in the construction of similar works in future. The settlement does not in any way affect the stability of the work, and would only be apparent to the careful scrutiny of a professional eye. When it is practicable to avoid settlement, the bases of works of this description should always be well weighted previous to the superstructure being commenced; as where substratum is compressible, the additional weight of the superstructure must cause it to yield in some degree.

11. In the Board's letters No. 5717 and 202, dated respectively 8th December and 16th January last, I was called on to make experiments in cements, with a view to obtain a cheap water cement, and to report upon the Aden pumice with regard to its quality as an ingredient for the same. The result of my experiments is shewn in the annexed statement No. II. By this it will be seen, that all the different clays, brick and tile earth and moorum, found in the vicinity of Bombay when calcined, pulverized, and mixed either with Bombay or Poona lime, form an excellent water cement, either in fresh or salt water. The Aden pumice used in a similar way forms a cement superior to any of the above, and is I conceive a most valuable ingredient.

12. The best proportion for use with any of the above ingredients appeared to me to be two parts lime, one part sand, one part pulverized cement. The term cement I have applied to the different clays &c. when calcined and pulverized.

13. The cheapest mode of working the cement on a large scale appears to me to be to appropriate a Ganee (Mill) entirely to its use, close to the chunam Ganees, with two sifting frames attached, one for every two of the latter, the larger particles in the sieve being constantly thrown back into the Ganee and a fresh supply added as quickly as possible; by this method the cost of the cement will be about one half the cost of chunam, and sand worked up ready for use, or in other words, the usual cost of chunam ready for use increased by one half, will be the cost of the water cement ready for use.

14. Both the Bombay and Poona limes are hydraulic, though slow setting below water, but when used above the surface of the water they set quickly enough for almost any purpose. I would not therefore

recommend the cement being used except under water, or where it would not be allowed to dry, as I found that when this was the case, after long immersion it cracked for three or four feet above low tide mark: in damp situations it may be used with great advantage.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) J. ESTRIDGE, Captain,

Engineer to the Dock Yard.

Bombay, Dock Yard Engineer's Office,
6th August 1847.

No. I.

Statement shewing the Actual Expenditure upon Works carrying on under the Engineer to the Dock Yard, for the official year from 1st May 1846 to 30th April 1847.

No.	Name of Works.	Amount.			Total.		
		Rs.	a.	p.	Rs.	a.	p.
1	Constructing a Building Yard to the South East of the Dock Yard and Saluting Battery, comprising three slips for building ships of war, of the 1st class, of Her Majesty's Navy	2,995	14	8			
2	Erecting a Coal Depôt on the East side of Colaba Causeway, between the Merchants' Ground and Apollo Pier	5,269	10	2			
3	Erecting a new Smithy on the New Ground and converting the old Smithy into a store for machinery for the Factory	5,257	15	6			
4	Erecting a teak palisading enclosing the ground proposed to be made over to the Dock Yard, and removing the coal and mast-sheds, and erecting in lieu two double tiled sheds with a cook-room for the boat crews	1,700	0	0			
5	Making additions and alterations to the offices of the Superintendent of the Indian Navy in the Dock Yard	4,835	14	4			
6	Making a channel along the Southern wall of the New Ground	33	4	4			
7	Placing fender posts along the face of the wharf wall under the large crane near the Factory	815	1	6			
8	Erecting a shed at the head of the Dock	3,713	0	0			
9	Furnishing stones for the benches of the new Saw Mill, and backing up the footing wall of the shed with rubble masonry	27	8	0			
10	Erecting a gun-shed in the Dock Yard	6,315	0	0			
					30,963	4	6
	Repairs to Fortifications and Buildings.						
1	Widening the entrance of the Stern Duncan Dock	13,642	14	5			
2	Widening the upper Duncan Dock, and constructing grooves for a Caissoon	11	14	0			
3	Erecting a cadjan shed over H. M. Ship Meanee	4,080	0	0			
4	Covering with cadjans the Brigs Zenobia and Goshawk	850	0	0			
5	Erecting a cadjan shed over the new Steam Packet under construction in the upper Duncan Dock	1,057	0	0			
6	Special repairs to the buildings in the Dock and Building Yards for 1846	420	0	0			
7	Securing the blocks for the Satellite to be hauled upon	124	2	10			
8	Annual repairs to the Buildings in the Dock and Building Yards for 1846	2,483	0	0			
		22,668	15	3	30,963	4	6

Statement.—(Continued.)

No.	Name of Works.	Amount.			Total.		
		Rs.	a.	p.	Rs.	a.	p.
	Brought over Rs....	22,668	15	3	30,963	4	6
9	Repairing store room and removing the chains for the water contractor.....	245	10	8			
10	Repairing the Boiler-makers' shed on the New Ground...	379	0	0			
11	Constructing masonry work for the Boiler of the Dock Yard Steam Kiln.....	49	2	3			
12	Improving the ventilation of the Smithy attached to the Factory in the Dock Yard.....	84	0	0			
13	Improving the Apollo Pier.....	28,032	5	7			
14	Putting up a revolving light in the Light House.....	277	8	9			
15	Experiments for water cement.....	100	5	10			
16	Making alterations to the Lanthorn of the Light House at Colaba.....	51	0	0			
17	Annual repairs to the public buildings in the Dock and Building Yards for 1847.....	400	0	0			
					52,288	0	4
		Rupees....			83,251	4	10

Errors Excepted.

(Signed) J. ESTRIDGE, Captain,

Engineer to the Dock Yard.

Bombay, Dock Yard Engineer's Office,
6th August 1847.

No. II.

Schedule of Experiments in Water Cement.

Months and dates.	Number of experiment.	Proportions.	Remarks.
1847. January	30th 1	One part Poona lime fresh calcined and slaked, one part calcined white clay pulverized.....	This began to set almost immediately, and in 48 hours was quite hard.
	2	One part Bombay lime sifted and ground, one part calcined white clay pulverized.....	This after 48 hours had set firmly, but not so hard as the above—has since become quite hard.
February	1st 3	Common Bombay lime and sand taken from the Gar, worked up and placed into water.....	Set slowly and gradually hardened;—on the 8th July it was taken out and found to have hardened so much as to require some force to break it.
	4	One part Bombay lime sifted, one part calcined white clay pulverized.....	This mixture has also set well.
	5	Two parts Bombay lime sifted, one part calcined white clay pulverized.....	This has set very hard.
	6	One part Bombay lime sifted, one part calcined white clay pulverized, one part Sea sand.....	This has set firmly, but not so hard as the above.
	7	One part Poona lime fresh slaked, one part calcined white clay pulverized.....	This has set very hard.
	8	Two parts Poona lime fresh slaked, one part calcined white clay pulverized.....	Ditto.....ditto.
	9	One part Poona lime fresh slaked, one part calcined white clay pulverized, one part Sea sand.....	Ditto.....ditto.
,,	3rd 10	One part Bombay lime sifted, one part calcined white clay pulverized.....	This has set very well.
	11	Two parts Bombay lime sifted, one part calcined white clay pulverized.....	This better than the above; very good.
	12	One part Bombay lime sifted, one part calcined white clay pulverized, one part Sea sand.....	Has set firmly, but inferior to the above.
	13	One part Bombay lime sifted and ground, one part calcined white clay pulverized.....	This is very good.
	14	One paart Poona lime slaked, one part calcined white clay pulverized.....	Very good.
	15	Two parts Poona lime slaked, one part calcined white clay pulverized.....	Ditto.

Schedule—(Continued.)

Months and dates.		Number of experiment.	PROPORTIONS.	REMARKS.
1847.				
February	3rd	16	One part Poona lime slaked, one part calcined white clay pulverized, one part Sea sand.	Very good.
„	4th	17	One part Bombay lime sifted, one part calcined red clay pulverized.	Ditto.
		18	One part Bombay lime sifted and ground, one part calcined red clay pulverized	Ditto.
„	5th	19	One part Poona lime fresh slaked and sifted, one part calcined red clay pulverized	Ditto.
„	23rd	20	One part Poona fresh slaked, one part calcined Aden pumice pulverized, one part Sea sand.	Ditto.
		21	Poona lime alone pulverized.	Sets firmly, and hardened in three or four days.
		22	Aden pumice alone pulverized.	Will not harden.
		23	One part Poona lime fresh slaked, one part calcined Aden pumice pulverized.	Very good.
		24	One part Bombay lime sifted and ground, one part calcined Aden pumice pulverized.	Set slowly, but very hard.
„	24th	25	One part Poona lime, one part Sea sand pulverized.	Set well and firmly.
		26	One part Poona lime, one part calcined Aden pumice pulverized with salt water.	Set very hard.
„	25th	27	One part Bombay lime sifted and ground, one part calcined Aden pumice pulverized with salt water.	Set slowly, but very hard.
March	9th	28	One part Poona lime, one part calcined brick earth pulverized. . . .	Set in 24 hours, and in a week very hard.
		29	One part Bombay lime sifted and ground, one part calcined brick earth pulverized.	Ditto. . . . . ditto.
„	11th	30	One part lime Tarapooree fresh slaked, one part calcined brick earth pulverized.	Ditto. . . . . ditto.
		31	Tarapooree lime fresh slaked by itself.	Set very slowly, but gradually hardened.
„	12th	32	Poona lime first sort fresh slaked by itself.	Set slowly, but gradually hardened.
		33	One part Poona lime fresh slaked, one part calcined brick earth pulverized.	Set in 24 hours and hardened.
„	16th	34	One part Poona lime, one part calcined brick earth pulverized. . . .	Ditto. . . . . ditto.
		35	One part Bombay lime sifted and ground, one part calcined tile earth pulverized.	Ditto. . . . . ditto.

Schedule—(Continued.)

Months and dates.		Number of experiment.	PROPORTIONS.	REMARKS.
1847.				
March	18th	36	Two parts Bombay lime with sand as taken from the Gar, one part calcined clay pulverized and sifted..... Ground together in the common chunam Ganees.	A piece of rubble masonry about 2 feet cube was built in the harbour at the low tide mark spring tides when they were going off, and on being inspected the next springs, was found to have set very hard.
„	20th	37	Two parts Bombay lime with sand as taken from the Gar, one part calcined Aden pumice pulverized and sifted..... Ground together in the common chunam Ganees.	Ditto.....ditto.
„	24th	38	One part Poona lime first sort, one part tile earth without being fresh calcined, pulverized.....	Set in 24 hours and hardened.
„	26th	39	One part Poona lime first sort fresh slaked, one part calcined red moorum pulverized.....	Ditto.....ditto.
		40	One part Poona lime first sort fresh slaked, one part calcined yellow moorum pulverized.....	Ditto.....ditto.
„	29th	41	One part clay lime fresh slaked by itself.....	Set well and quickly, and hardened well.
„	30th	42	One part clay lime fresh slaked, one part calcined yellow moorum pulverized.....	Ditto.....ditto.
April	1st	43	Surat lime fresh slaked by itself.....	This has not set at all.
February	5th	44	One part Bombay lime, one part sand as taken from the Gar.....	This was allowed to remain under water 5 months, and when taken out was quite hard.

(Signed) J. ESTRIDGE, Captain,

Engineer to the Dock Yard.

Bombay, Dock Yard Engineer's Office,
6th August 1847.

No. 1444 of 1847.

To

The Secretary to the Military Board,

Bombay.

Sir,

I have the honor to lay before the Military Board a Statement, drawn up in the prescribed form, of the Expenditure in the Public Work Department of the Province of Scinde, during the year 1846 | 47, and to be, &c.

(Signed) A. C. PEAT, Major,

Superintending Engineer,

Scinde.

Kurrachee, 9th August 1847.

(True copy,)

(Signed) N. H. THORNBURRY, Captain,

Secretary Military Board.

Account of the Expenditure in the Public Work Department in the Province of Scinde, during the year 1846 | 47.

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Lower Scinde Division.						
Kurrachee.						
Annual and special repairs to the Buildings in the Military Department	4,161	7	8			
				4,161	7	8
Watering and preserving trees both round the European Infantry Barracks, and on the sides of the road between the Kurrachee Bunder and Cantonment	483	5	0			
Repairing wells and water-wheels	98	1	7			
White-washing Hospitals, &c	793	8	8			
Cow-dunging the whole of the Military Buildings occupied by the European Troops	1,615	4	8			
Fixing panes of glass to different buildings in place of those broken by storms	82	3	4			
Petty supplies for purifying European necessaries	71	0	5			
Repairing and keeping in order the boring apparatus	55	4	6			
Constructing the railings for the Engineer's Store Yard	71	10	8			
Repairing the General Hospital	76	10	7			
Repairing cracks of the Chunam floor of the European Infantry Barracks water-room	0	15	6			
Removing the railings of the Engineer Store Yard	14	11	9			
Skittle alleys, 60th Royal Rifle Barracks	105	2	8			
Repairing doors and windows of the 12th Regiment Native Infantry Hospital						
Repairing the ridge pole of the European Sappers and Miners' Chuppers	15	13	1			
Cleaning the drains that feed the Ram Bany Tank	12	12	0			
Sprinkling quicklime, &c. over the graves of all the cholera cases	106	8	9			
Repairing the European Sappers and Miners' Chuppers	61	3	1			
Skittle alleys in 1st Fusiliers Barracks	62	14	11			
Making a large press for the Executive Engineer	37	6	2			
Repairing the Office Theodolite	10	0	0			
Cleaning the lines of His Excellency the Governor's escort	6	6	0			
Removing the two necessaries in the Old Artillery lines	21	10	10			
Repairing the doors and windows of the European Infantry patcheries	94	10	5			
Making a box for the Executive Engineer's Office	9	4	2			
Building fire-places in the cook-rooms of the Artillery pendalls on the heights	33	1	10			
Carried forward Rs.	3,939	10	7	4,161	7	8

Lower Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*
Brought over Rs....	3,939	10	7	4,161	7	8
Constructing gate-ways in the paling of the Engineer's Store Yard	6	6	6			
Piling stones at Ram Bang	85	8	3			
Repairing doors and windows of the Horse Artillery Patcheries	4	8	0			
Plastering the walls of the old Necessary and Cook-house of the European Infantry Hospital	24	5	6			
Removing the rubbish of the old Quarter Guard in the European Infantry lines	11	4	0			
Raising the portion of the ground upon which the butts of the Rifles rest in the arm racks of the European Infantry Barracks	89	13	1			
Levelling the ground at the extreme left of the European Infantry Barracks	97	6	0			
Supplying copper basins for the use of the solitary cells	19	8	0			
Repairing the 3rd Regiment Native Infantry Hospital Cook-room	21	7	0			
Repairing the windows of the Secretary's Office	4	2	4			
Disbursed for the damages sustained by the brick contractor during the rain storm	42	0	0			
Making iron tent pegs for Her Majesty's 86*th* Regt	86	4	0			
Removing the temporary Cook-room and Necessary near the General Hospital	7	8	0			
Removing the anchor from Clifton to the Engineer Store Yard	7	9	0			
Repairing the beacon of the Menora Fort Light House	86	6	5			
Excavating wells in the Belooch Battalion lines	51	1	8			
Enlarging windows in the lock-up room of the Horse Artillery Quarter Guard	29	4	6			
Turning Tiles of the No. 3 Horse Artillery Barracks verandah	40	12	4			
Constructing a semi-circular wall at the end of, and distant a few feet from, the troughs of 4 | 1 s. o. Artillery well	145	8	5			
Removing and re-building the temporary Cook-room and Necessaries of Her Majesty's 86th Regiment and 1st Bombay Fusiliers	157	8	3			
Repairing verandah of the European Infantry Barracks	219	2	8			
Repairing the Ordnance Workshop	105	12	1			
Additions to the old well in the Horse Artillery lines	98	15	11			
Removing an old shed from the Artillery lines	8	3	10			
Repairing the temporary Cook-room attached to the 2nd Troop Horse Artillery Barracks	16	14	5			
Levelling the new Parade ground	127	7	9			
Making a press for Government House	144	3	6			
Digging drains about the Engineer's Artificers' lines	45	10	3			
Supplying two lamps and one new reflector, and re-silvering an old reflector, for the use of the Light House at Menora	15	0	0			
Carried forward Rs.....	5,738	4	3	4,161	7	8

Lower Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs.....	5,738	4	3	4,161	7	8
Making a press for the Assistant Quarter-Master General's Office.....	74	5	10			
Repairing the sentry boxes in the Ordnance Department....	2	12	3			
Cleaning the drains of No. 2 Barrack of Her Majesty's 60th Rifles.....	5	7	6			
Repairing the 3rd Regiment Native Infantry Hospital doors, windows, &c.....	10	10	3			
Repairing the 2d Troop Horse Artillery temporary Hospital.	82	5	4			
Repairing the trusses of the Church Bungalow.....	118	15	4			
Partitioning the European New Pendalls, for the accommodation of the families of the 1st Bombay European Fusiliers.....	348	13	1			
Cleaning the pendalls of the Belooch Battalion.....	9	0	0			
Building eight fire-places in four of the European New Pendalls.....	58	7	0			
Partitioning No. 10 European New Pendall for a guard room for the 60th Royal Rifles.....	92	5	5			
Placing a rafter in order to support the corner of the house occupied by the Jemadar of the 4th or Rifle Corps.....	1	7	4			
Renewing a broken post plate, &c. of the Hospital occupied by the 60th Royal Rifles.....	6	2	0			
Plastering with mud, the roof of the Hospital Guard-room of the 60th Royal Rifles.....	22	12	7			
Oiling the trunks of the Fire-engine.....	3	10	0			
Repairing Horse Artillery Patcheries.....	8	12	8			
Replacing Tiles on a portion of the Church Bungalow.....	4	12	0			
Repairing the drains leading from the wash-house to the Cess Pools at No. 7 Barrack-room occupied by Her Majesty's 60th Royal Rifles.....	1	8	10			
Partitioning the European New Pendalls for eight married men, of the 1st Bombay European Regiment Fusiliers.....	46	7	10			
Replacing a broken principal in one of the verandahs of the European Barracks, occupied by Her Majesty's 60th Royal Rifles.....	1	5	0			
Fencing the Secretary's Office compound with mangrove..	136	6	5			
Re-building an old well in the Horse Artillery Lines.....	358	7	2			
Excavating drains round the 25th Native Infantry Lines.	800	0	0			
Ditto ..... ditto, European New Pendalls.....	363	10	3			
Ditto wells for three Companies of Artillery.....	262	14	10			
Punkering the Pendalls on the heights.....	3,254	8	7			
Repairing and making good the road between Cantonment and Bunder.....	49	1	2			
Placing covers over the cess-pools of the European Infantry Barracks.....	95	13	8			
Fixing arm-racks, shelves, and pegs to the Artillery Pendalls on the heights.....	1,029	0	0			
Ditto ..... ditto ..... ditto, to the European New Pendalls.....	5,589	11	2			
Carried forward Rs....	18,577	13	9	4,161	7	8

Lower Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	18,577	13	9	4,161	7	8
Planting a milk bush hedge inside, and a prickly thorn hedge outside, the old grave yard.....	218	0	0			
Draining the cantonment..	33	9	6			
Making and fixing new glass windows to the Serjeant's rooms in the Barracks occupied by the 60th Royal Rifles.....	332	5	9			
Chunaming the eaves of the roofs of the 9th Barrack occupied by the 60th Royal Rifles...	686	1	7			
Building a stone pillar, and replacing another of the grave yard gate-way...	11	3	2			
Additions and alterations to the Artillery Pendalls on the heights..	5,640	0	0			
Enclosing the Burial-ground with rubble stone, and mud pointed with line masonry wall.	200	0	0			
Building well for the 2nd Troop H. A...	218	12	0			
Armourer's shed in the E. I. Lines.	84	5	7			
Building three Urinaries, one to the Rear-guard, and two to the School-rooms of Her Majesty's 60th Rifles..	136	14	3			
European New Pendalls for 1800 Europeans.	93,533	5	4			
Temporary Bathing-sheds, Cook-rooms, and Necessaries to European New Pendalls.....	2,555	0	0			
Government House additions, out-offices, &c....	34,342	4	9			
Metalling a portion of the road between Camp and Kurrachee Bunder.....	809	2	6			
Mole at the Kurrachee Bunder.	30,721	0	11			
Additional Cook-room in the E. I. Lines.....	561	11	7			
Additional Necessary in the European Infantry Lines.. ..	528	15	6			
25th Native Infantry Lines..	38,310	4	5			
Horse Artillery Barracks..	22,924	10	6			
Horse Artillery Hospital....	2,298	9	4			
Ditto Urinaries....	54	8	0			
Ditto Sick horse stable..	96	12	9			
Ditto Hospital male Cook-rooms.....	112	10	6			
Ditto Ditto female Ditto..	77	6	0			
Ditto Ditto Necessary and Urinaries....	37	2	0			
Building 28 Fire-places under the verandahs of the European New Pendalls.....	140	0	0			
Guard-room Necessary, and Sentry walls at the Ordnance Stores.....	444	4	7			
Building temporary Necessary to the Horse Artillery Patcheries, and temporary Cook-room to the Horse Artillery Hospital.....	57	13	7			
Ditto Workshop for the 1 | 1 s. o. or Captain Bailey's Company of Artillery.....	64	11	4			
Ditto Ditto for the 1 | 2 s. o. or Captain Forster's Company of Artillery.....	64	11	4			
Ditto Ditto for the 3 | 2 s. o. or Captain Turnbull's Company of Artillery..	64	11	4			
Ditto Ditto for the Artillery Farriers	64	11	4			
Carried forward Rs....	2,54,003	9	2	4,161	7	8

Lower Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	2,54,003	9	2	4,161	7	8
Building an Office for the Ordnance.....	80	0	0			
Ditto three temporary Cook-rooms for the 1st Bombay European Regiment Fusiliers.....	218	0	0			
Ditto two temporary Necessaries for Ditto.....	148	0	0			
Ditto two temporary Cook-rooms and two Necessaries for H. M.'s 86th Regiment.....	293	0	0			
Building two temporary Cook-rooms, one Necessary, and one Bathing-shed for the families of the 1st Bombay European Regiment of Fusiliers.....	120	0	0			
Building one temporary Cook-room for the families of the 1st Fusiliers in place of the one destroyed by fire.....	26	8	5			
Building one temporary Cook-room and one Necessary to the General Hospital.....	61	4	2			
Total Company's Rupees....	.....	..	..	2,54,950	5	9
Garrah.						
Repairing the 10th Regiment Native Infantry Lines at Garrah.....	1,498	2	10			
Total Company's Rupees...	.....	..	..	1,498	2	10
Barrack Department						
Supplying Barrack Furniture.....	679	8	0			
Ditto Charpoys.....	343	0	0			
Ditto Copper ware for European Troops.....	2,038	0	0			
Securing the ends of Cotboards (100).....	25	14	11			
Supplying empty water casks for European Troops.....	112	0	0			
Removing, arranging, and repairing Barrack furniture....	629	12	7			
Supplying Oil and Cotton Wicks for the European Troops..	1,219	1	6			
Total Company's Rupees..	.....	..	..	5,047	5	0
Total Lower Scinde Division.....	.....	..	..	2,65,657	5	3

Central Scinde Division.

Hydrabad.

Names of Works.	Rs.	a.	p.
New European Infantry Barracks.....	74,208	10	2
New Line of Road from Entrenched Camp to Port of Hydrabad.....	4,028	11	4
Metalling 600 feet of road.....	347	5	7
Carried forward Rs....	78,584	11	1

Central Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	78,584	11	1			
Making two Treasure Chests for Collector of Hydrabad....	167	1	9			
Building a wall round the office Bungalow of the Deputy Collector Hydrabad.....	211	15	8			
Alterations to the Deputy Collector's Bungalow at Hydrabad.....	124	15	7			
Repairs to the Artillery Hospital in the Entrenched Camp..	326	2	7			
Making Shot Terraces.....	125	13	8			
Petty Repairs.....	2,947	11	10			
Total Company's Rupees...	.....	...	...	82,488	8	2
Mahmed Khans Sanda.						
Repairs to the Deputy Collector's Bungalow at Mahmed Khans Sanda.....	295	10	11			
Total Company's Rupees...	.....	..	..	295	10	11
Kolree.						
Amount expended on the works at Kolree.....	1,106	13	0			
Total Company's Rupees..	.....	..	..	1,106	13	0
Total Central Scinde Division...	.....	..	..	83,891	0	1

Upper Scinde Division.

Sukkur.

Names of Works.	Rs.	a.	p.
Alteration to old European Barracks.....	4	9	0
Constructing European Hospital.....	129	0	0
Additions and alterations to Medical Store-room G. Hospital.....	10	14	0
Constructing Gun-sheds in Fort Bukkur.....	1,526	15	3½
Repairing Huts of the 7th Regiment Native Infantry Lines.	4,164	12	8½
Constructing Arm-racks for H. M's. 17th Foot.....	1,217	3	8
Making up jewassa tatties and watering them.....	4,774	12	6
Repairing Pontoons.....	300	15	10
Clearing out Fort Bukkur.....	66	8	0
Filling water-casks.....	37	1	0
Repairing Hospital 11th Regiment Native Infantry.....	3	3	0
Repairing Verandah and Chicks Hospital 11th Native Infantry.....	20	8	0
White-washing 11th Regiment Native Infantry Hospital....	11	11	0
Carried forward Rs....	12,268	2	0

Upper Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	12,268	2	0			
Repairing filth cart	5	6	0			
Removing Barrack furniture	3	8	0			
Repairing and putting up Chicks European Barracks	23	10	11			
Removing Field park to the Fort	8	2	0			
Constructing Sentry Box	1	8	0			
Levelling old Tombs about Cantonment	284	2	0			
Repairing General Hospital	25	0	5			
Cleaning out well in front of European Barracks	3	7	0			
Cleaning and deepening well in the Horse Lines of the 4 | 1 s. o. Artillery	1	4	0			
White-washing New European Barracks	109	5	3			
Putting up Chicks 4 | 1 s. o. Artillery	0	15	5			
Clearing out 2 wells in rear of H. M's 17th Regiment Bazar	4	5	0			
Constructing temporary partition between the sick Europeans and Natives of the 4 | 1 s. o. Artillery	7	5	9			
Constructing temporary Verandah to H. M's 17th Regiment	871	10	7½			
Making up Targets	334	8	0			
Repairing Residency buildings	10	12	9½			
Constructing quarter guard 4 | 1 s. o. Artillery	979	14	2			
Cowdunging Barracks 4 | 1 s. o. Artillery	5	12	0			
Repairing doors and windows 4 | 1 s. o. Artillery	3	10	4			
Repairing a beam in a hut of the 11th Native Infantry	1	0	0			
Constructing solitary cells 4 | 1 s. o. Artillery	827	0	11			
Repairing Sepoys' Lines 11th Regiment Native Infantry	3	13	10			
White-washing Hospital 4 | 1 s. o. Artillery	14	12	0			
Cleaning out Fort Bukkur	21	14	11			
Blasting Rocks on the high roads	29	15	7			
Repairing Sepoys' Lines 11th Regiment Native Infantry	7	15	0			
Repairing Collector's Cutcherry	10	9	10			
White-washing Hospital 11th Regiment Native Infantry	10	2	6			
White-washing Hospital Baggage Corps, and Dooly Bearers	6	12	0			
Constructing Lascar Lines in Fort Bukkur	4,507	10	3½			
Painting a pontoon train	278	8	0			
Constructing huts at Meerpoor	119	4	0			
Ditto....do. at Moolarickpoor	119	0	0			
Ditto Infantry Lines at Shahpoor	1,709	12	6			
Repairing Hospital at Shahpoor	75	14	9			
Constructing godown at Shahpoor	84	15	3			
Constructing godown at Meerpoor	30	1	8			
Packing Medical Stores	1	8	0			
Making up mining frames	208	15	0			
Repairing a hut 11th Regiment Native Infantry	0	8	0			
Removing Barrack furniture	28	7	9			
Hanging up Chicks Hospital 7th Regiment Native Infantry	4	12	2			
White-washing General Hospital	6	10	0			
Making chicks for ditto	81	4	0			
Repairing privy seats in Hospital of the Camel Baggage Corps	10	14	4			
Carried forward Rs....	23,154	7	11½			

Upper Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	23,154	7	11½			
Clearing the open space of ground on the right of the Golundauz Lines.....	2	4	0			
White-washing Hospital 7th Regiment Native Infantry..	4	6	7			
White-washing Hospital 11th Regiment Native Infantry..	5	0	0			
White-washing Officers' Qrs. in Fort Bukkur.....	3	8	0			
Making up chicks for doors and windows, Hospital Camel Baggage Corps....	42	11	6			
Repairing Collector's Kutcherry....	3	4	4			
Repairing a hut in the Lines of the 11th Regt. N. Infantry.	11	1	0			
Repairing Barracks and Ordnance Store-rooms in Fort Bukkur.....	33	1	3			
Repairing Commissariat godown.....	12	10	1			
Total Company's Rupees..				23,272	6	8½
Shikarpoor.						
Repairing and cleaning wells.....	95	10	4½			
Re-roofing Infantry Hospital and Medical Store-room, and repairing and replacing Hamps.....	256	6	8			
Re-roofing Commissariat Store-room, and constructing a drain in the New Fort.....	162	9	6			
Re-pairing wells in the Lines of the 3rd Cavalry.....	90	3	0			
Re-roofing Residency Bungalow.....	133	6	6			
Re-roofing Cavalry Barracks.....	178	0	3			
Re-roofing Cavalry Saddle-room....	102	2	3			
Repairing a well in the Artillery Lines....	50	13	0			
Replacing and repairing hamps to the Hospital 3rd Light Cavalry.....	53	3	10½			
Constructing a wall in front of the entrance of the New Fort.....	16	14	0			
Repairing Infantry Barracks.....	44	0	5½			
Repairing a well in the Infantry Lines.....	8	13	1			
Repairing two Cavalry wells.....	97	8	5¾			
Repairing Cavalry Barracks.....	6	0	6			
Re-roofing Infantry Barracks.....	89	2	5¾			
Re-roofing Cavalry Lines	123	11	4½			
Repairing and cleaning wells in the Golundauze Lines....	45	15	4			
White-washing Hospital 3rd Cavalry.....	26	4	½			
Cleaning wells in the Artillery Lines.....	11	11	0			
Repairing three wells in the Lines of the 3rd Light Cavalry.	30	15	6			
Repairing well and godown in Commissariat Fort.....	10	14	0			
Repairing Infantry Lines.....	44	15	1			
Repairing the Riding Master and Quarter Master Serjeant's Bungalows 3rd Light Cavalry.....	11	13	0			
Repairing a well in the Artillery Lines.....	1	13	6			
Repairing verandah in the Commissariat Fort, and two Barracks in the Irregular Cavalry Lines.....	23	8	7			
Carried forward Rs...	1,716	7	9¾	23,272	6	8½

Upper Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	1,716	7	9¾	23,272	6	8½
White-washing Hospital 4th Rifles.....	19	2	10			
Repairing a well in the Cavalry Lines.....	64	9	11½			
White-washing Artillery Staff Serjeant's Bungalow.....	3	9	5			
Rapairing Quarter Guard 3rd Light Cavalry.....	18	8	11			
Repairing saddle-room 3rd Light Cavalry.....	21	11	5			
Repairing six Barracks 3rd Light Cavalry.....	199	10	3			
Repairing Collector's Bungalow.....	241	12	10			
Repairing two Barracks 4th Regiment Rifles.....	54	8	9			
Repairing well in the Artillery Lines.....	8	1	10			
Repairing a well in the 3rd Light Cavalry Lines.....	1	14	0			
Repairing a well in the Commissariat Department.....	3	5	0			
Repairing a well in the Lines of the 3rd Light Cavalry..	1	13	0			
Repairing Barrack 4th Regiment Rifles.....	2	14	10			
Repairing two wells 3rd Light Cavalry.....	0	12	6			
Removing Barrack Furniture.....	1	8	0			
Repairing Acting Serjeant Major's Bungalow 7th Regiment Native Infantry.....	6	5	3			
Repairing the Residency out-offices.....	192	7	5			
Repairing Huts 7th Regiment Native Infantry.....	21	10	0			
White-washing Staff Non-commissioned Officers' Quarters 7th Regiment Native Infantry.....	4	9	0			
White-washing Staff Non-commissioned Officers' Quarters 18th Regiment Native Infantry.....	6	9	2			
Repairing a well in the Commissariat godown.....	5	3	7			
Repairing Hamps Artillery Hospital.....	12	0	4			
Repairing Hams Hospital 7th Native Infantry.....	11	13	7			
White-washing and repairing Hospital 18th Regiment Native Infantry.....	16	8	4			
Repairing two wells in the Lines of the 18th Regiment Native Infantry.....	18	13	9			
White-washing and repairing Artillery Staff Serjeant's Quarters.....	8	10	3			
White-washing and repairing Artillery Barracks.....	92	5	0			
White-washing and repairing Artillery Quarter guard.....	14	14	5			
White-washing Artillery Hospital.....	60	7	5			
Repairing Lines of the 7th Regiment Native Infantry.....	21	15	6			
Repairing Artillery Gun-sheds.....	49	14	6			
Repairing Commissariat godown.....	129	3	11			
Ditto..two Artillery Necessaries.....	1	9	5			
Ditto..Artillery workshop.....	3	2	0			
Ditto..two Artillery wells.....	8	14	0			
Total Company's Rupees.....	.....	..	..	3,047	8	2¼
Carried forward Rs.....	.....	..	..	26,319	14	10¾

Upper Scinde Division.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	.....	..	..	26,319	14	10¾
Larkhana.						
Making and hanging up Chicks Hospital Camel Corps....	193	4	8			
White-washing Hospital Scinde Camel Corps....	80	8	8			
Repairing ten Barracks for Scinde Camel Corps.....	22	11	0			
Repairing one Barrack for twenty Sepoys....	2	0	2			
Repairing out-offices attached to the Collector's Bungalow..	34	13	5			
Repairing upper story Scinde Camel Corps Hospital.....	15	11	8			
Repairing Collector's Bungalow.....	7	7	4			
Repairing one Line for Suwars.....	65	8	2			
Total Company's Rupees....	.....	..	..	422	1	1
Total Upper Scinde Division....	.....	..	..	26,741	15	11¾

Statement shewing the amount of Engineering and Superintendence, with reference to actual outlay.

Divisions and Names of Officers.	Total Expended on Public Works.	Amount of Establishment charged on Works.	Expenditure on Public Works not including Establishment.	Total of Establishment, including Military Pay and Allowance of Officers and Establishment charged to the Works.	Per centage upon the works for Engineering and Establishment.
Lower Scinde Division.					
Lieutenant Maxwell, Bengal Engineers, and Lieutenant Hill, Bombay Engineers.....	2,65,657 $\frac{3\,2}{1\,0\,0}$	4,994 0 0	2,60,663 $\frac{3\,2}{1\,0\,0}$	22,794 $\frac{4\,7}{1\,0\,0}$	8 $\frac{8}{1\,0}$
Central Scinde Division.					
Lieutenant Adams, Bombay Infantry, Lieut. Délisle, Bombay Engineers, Brevet Captain Weller, Bengal Engineers, and Lieutenant Burke, Bombay Engineers.....	83,890 $\frac{1}{1\,0\,0}$	2,218 $\frac{5\,7}{1\,0\,0}$	81,671 $\frac{4\,4}{1\,0\,0}$	17,079 $\frac{5\,9}{1\,0\,0}$	20 $\frac{9}{1\,0}$
Upper Scinde Division.					
Lieutenant Frazer, Bengal Infantry, Lieutenants Hill and Walker, Bombay Engineers.....	26,741 $\frac{9\,9}{1\,0\,0}$		26,741 $\frac{9\,9}{1\,0\,0}$	12,911 $\frac{9\,1}{1\,0\,0}$	48 $\frac{2}{1\,0}$

General Statement of Expenditure.

Division.	Amount Expended on Public Works.			Engineering and Establishment.			Total.		
	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*
Lower Scinde.....	2,60,663	0	0	22,794	0	0	2,83,457	0	0,
Central Scinde.....	81,671	0	0	17,079	0	0	98,750	0	0
Upper Scinde.....	26,741	0	0	12,911	0	0	39,652	0	0
Grand Total....	3,69,075	0	0	52,784	0	0	4,21,857	0	0

(Signed) A. C. PEAT, *Major,*
Superintending Engineer Scinde.

No. 938 OF 1847 | 48.

To,

THE SECRETARY MILITARY BOARD,

Bombay.

SIR,

I have the honor to forward the Annual Report of Works in the Northern Provinces, for the year ending 30th April 1847.

Statement of the Sums Expended by each Officer under the Superintending Engineer Northern Provinces, from 1st May 1846 to 30th April 1847.

Names of Officers.	In the Military Department.			In the General Department.			In the Judicial Department.			In the Revenue Department.			In the Territorial Department.			In the Political Department.			Total.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Captain Hart and Brevet Major Goodfellow, Acting and Executive Engineers Surat and Broach.....	11,018	2	10	9,780	3	9	5,038	5	3	397	15	6	477	14	0	.....	..	..	26,712	9	4
Captain Morse and Lieutenant Dickinson, Acting and Executive Engineers of Ahmedabad.....	8,997	6	4	35,820	6	8	6,579	8	11	3,194	0	2	216	0	0	1,207	12	11	56,015	3	0
Lieutenants Hoollcombe and Robertson, Acting Executive Engineers at Deesa.	17,007	14	11	108	8	11	.....	..	..	.....	..	..	.....	..	..	.....	..	..	17,116	7	10
Lieutenant Peacocke, in charge of Public Works at Rajcote.....	371	15	2	.....	..	..	.....	..	..	.....	..	..	.....	..	..	1,559	9	4	1,931	8	6
Lieutenants Davison and Moyle, in charge of Public Works at Bhooj.....	1,509	9	0	.....	..	..	.....	..	..	.....	..	..	.....	..	..	419	0	0	1,928	9	0
Grand Total....	38,905	0	3	45,709	3	4	11,617	14	2	3,591	15	8	693	14	0	3,186	6	3	1,03,704	5	8

Statement shewing the cost of Engineering and General Superintendence of each Officer under the Superintending Engineer Northern Provinces, from 1st May 1846 to 30th April 1847.

Names of Officers.	Expense of Establishment per annum.			Expenditure			Rate per cent.
	Rs.	a.	p.	Rs.	a.	p.	
Captain Hart and Brevet Major Goodfellow, Acting Executive Engineers at Surat and Broach	10,952	3	9	26,712	9	4	41
Captain Morse and Lieutenant Dickinson, Acting and Executive Engineers of Ahmedabad	8,984	2	3	36,015	3	0	$16\frac{2}{4\,6}$
Lieutenants Hoollcombe and Robertson, Acting Executive Engineers at Deesa	5,516	8	0	17,116	7	10	$31\frac{1}{1\,7}$
Lieutenant Peacocke, in charge of Public Works at Rajcote	326	0	0	1,931	8	6	$16\frac{8}{9}$
Lieutenants Davison and Moyle, in charge of Public Works at Bhooj	300	0	0	1,928	9	0	$15\frac{7}{1\,2}$
Total Rs....	25,878	14	0	1,03,704	5	8	$25\frac{1\,5}{1\,6}$

During last year, no Works of general or permanent professional interest have been executed, and there do not appear to have been any facts recorded worthy of publication.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) W. B. GOODFELLOW, Bt. Major,

Acting Superintending Engineer, N. P.

Superintending Engineer's Office, N. P.
Surat, 5th November 1847.

No. 3176 of 1847.

GENERAL DEPARTMENT.

To,

The Secretary to the Military Board,

Bombay.

Sir,

I have the honor to forward the Annual General Report of the proceedings of the Department of Public Works in the Southern Provinces, during the official year 1846 | 47.

2. The total Expenditure from the 1st May 1846 to the 30th April 1847, in the Military and Civil Departments, is as follows:—

Total Expenditure in the Military and Civil Departments of the Several Executive Officers of the Public Work Department in the Southern Provinces.

Names of Divisions or Stations.	Amount Expended on each.			Amount of Superintendence.			Superintendence per centage.
POONAH.							
Military Department.	Rs.	a.	p.	Rs.	a.	p.	
Repairs	12,740	10	6				
Annual Repairs	10,608	4	0				
Special Repairs	6,197	10	0				
New Works	22,317	10	7				
Military Department Total	51,864	3	1				
Civil Department Total	35,608	6	7				
Grand Total	87,472	9	8	13,661	13	2	15 5/8
Civil Department.							
Repairs	8,910	5	3				
Annual Repairs	4,167	4	6				
Special Repairs	563	11	6				
New Works	21,967	1	4				
Civil Department Total	35,608	6	7				

Names of Divisions or Stations.	Amount Expended on each.			Amount of Superintendence.			Superintendence per centage.
AHMEDNUGGUR.							
Military Department.	Rs.	a.	p.	Rs.	a.	p.	
Repairs	1,655	13	6				
Annual Repairs	6,659	14	3				
Special Repairs	850	4	3				
New Works	11,462	7	2				
Military Department Total	20,628	7	2				
Civil Department Total	14,664	6	9				
Grand Total	35,292	13	11	11,909	11	1	33¾
Civil Department.							
Repairs	5,429	1	0				
Annual Repairs	1,036	3	11				
Special Repairs	456	15	5				
New Works	7,742	2	5				
Civil Department Total	14,664	6	9				
BELGAUM.							
Military Department.							
Repairs	787	5	6				
Annual Repairs	5,884	7	3				
Special Repairs	975	15	6				
New Works	6,800	4	8				
Military Department Total	14,448	0	11				
Civil Department Total	33,856	13	8				
Grand Total	48,304	14	7	12,524	6	8	
Deduct for Extra Establishment	1,450	13	4				
	46,854	1	3				26¾
Civil Department.							
Repairs	269	13	6				
Annual Repairs	13,708	2	2				
Special Repairs	10,883	14	10				
New Works	8,994	15	2				
Civil Department Total	33,856	13	8				

Names of Divisions or Stations.	Amount Expended on each.			Amount of Superintendence.			Superintendence per centage.
DHARWAR.							
Military Department.	Rs.	a.	p.	Rs.	a.	p.	
Repairs..	223	8	6				
Annual Repairs..	111	5	2				
Special Repairs..	.....	..	..				
New Works..	161	2	2				
Military Department Total.....	495	15	10				
Civil Department Total.....	26,607	12	4				
Grand Total.....	27,103	12	2	15,387	6	8	56¾
Civil Department.							
Repairs....	15,692	15	7				
Annual Repairs..	3,314	2	10				
Special Repairs....	2,555	7	3				
New Works....	5,045	2	8				
Civil Department Total.....	26,607	12	4				
KOLAPOOR.							
Military Department.							
Repairs....	.....	..	..				
Annual Repairs..	8,602	2	11				
Special Repairs..	.....	..	..				
New Works..	1,937	5	4				
Military Department Total.....	10,539	8	3				
Civil Department Total.....	842	1	9				
Grand Total.....	11,381	10	0	3,395	15	1	29 1/16
Civil Department.							
Repairs..	.....	..	..				
Annual Repairs....	.....	..	..				
Special Repairs..	.....	..	..				
New Works..	842	1	9				
Civil Department Total.....	842	1	9				

Names of Divisions or Stations.	Amount Expended on each.			Amount of Superintendence.			Superintendence per centage.
SHOLAPOOR.							
Military Department.	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*	
Repairs	.....	..	..				
Annual Repairs	2,302	0	0				
Special Repairs	376	0	0				
New Works	2,669	8	0				
Military Department Total	5,347	8	0				
Civil Department Total	139	14	6				
Grand Total	5,487	6	6	1,148	0	0	21
Civil Department.							
Repairs	.....	..	..				
Annual Repairs	59	12	3				
Special Repairs	80	2	3				
New Works	.....	..	..				
Civil Department Total	139	14	6				
KHANDEISH.							
Military Department.							
Repairs	1,290	4	0				
Annual Repairs	587	1	7				
Special Repairs	33	0	0				
New Works	.....	..	..				
Military Department Total	1,910	5	7				
Civil Department Total	53,272	6	11				
Grand Total	55,182	12	6	25,110	13	5	45½
Civil Department.							
Repairs	14,646	7	1				
Annual Repairs	1,472	2	3				
Special Repairs	106	0	0				
New Works	37,047	13	7				
Civil Department Total	53,272	6	11				

Names of Divisions or Stations.	Amount Expended on each.			Amount of Superintendence.			Superintendence per centage.
ASSEERGHUR.							
Military Department.	Rs.	a.	p.	Rs.	a.	p.	
Repairs..	284	0	3				
Annual Repairs....	545	0	0				
Special Repairs..	.....	..	..				
New Works..	.....	..	..				
Military Department Total.....	829	0	3				
Civil Department Total.....	.....	..	..				
Grand Total.....	829	0	3				
Civil Department.							
None.							
DAPOOLEE.							
Military Department.							
Repairs.	17	12	0				
Annual Repairs..	1,055	0	0				
Special Repairs..	749	6	0				
New Works..	145	0	0				
Military Department Total.....	1,967	2	0				
Civil Department Total.....	.....	..	..				
Grand Total.....	1,967	2	0	200	0	0	10
Civil Department.							
None.							
Grand Total amount of Expenditure.....	2,71,571	4	3				

3. The works during the last year have not been of such a nature as to afford opportunity for any remarks not already offered in the last report.

4. But I would beg to forward for the information of the Board, the accompanying Annual Reports, in the General and Territorial Departments, and the Civil Engineer in Candeish, which are most detailed and clear, and on which great labor has been bestowed by Lieutenant Hart.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) W. HARRIS, Major,

Acting Superintending Engineer, S. P.

Superintending Engineer's Office, S. P.
Poona, 30th December 1847.

No. 703 of 1847.

GENERAL DEPARTMENT.

To,

The Superintending Engineer Southern Provinces,

Poona.

Sir,

1. I have the honor to submit my Report for the official year 1846 | 47, of the proceedings of the Civil Engineer's Department in Khandeish.

2. The account of the Expenditure is as follows :—

Names of Works.	Amount.			Total.	
Works connected with the communications of the Provinces.	Rs.	*a.*	*p.*		
Annual repairs to the Agra road, between the foot of the Chandore Ghaut and Scindwa.....	9,600	6	10		
Annual repairs to the road between Rawere and Dhurungaum.....	2,222	1	2		
Annual repairs to the road between Joregah and Nusseerabad.....	2,425	8	0		
Agra road, Chandore Ghaut, to Scindwa (monthly sanction of 1,000 Rupees).....	19,078	5	9		
Humla Causeway.....	22	7	2		
Carried forward Rs.....				33,348	12 11

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	.....	..	..	33,348	12	11
Bhundarras and Tanks.						
Lone Kheira Bhundarra.....	239	11	0			
Cunassee Bhundarra....	7,338	4	9			
Patonde Bhundarra...	398	7	1			
	7,976	6	10	7,976	6	10
Buildings.						
Cotton gin house Dhurungaum..	379	11	11			
Annual and Special repairs, Territorial Department Collector's..	466	11	2			
Kutcherries, &c. at Dhoolia, Special repairs to the Collector's Dwelling-house at Dhoolia....	106	0	0			
Constructing ventilators in the Dhoolia Jail.... ..	957	0	6			
Annual and special repairs Judicial Department to Jail Adawlut &c. at Dhoolia..	392	0	0			
Annual repairs to the temporary Buildings in the Fort of Malligaum....	176	10	11			
Altering the Centre Guard-room to the Dhoolia Jail.....	1,376	7	8			
Constructing Urinaries to the Jail at Dhoolia..... ..	549	0	0			
Constructing a Bungalow for the W. Bheel Agent Nundoorbar....	1,078	12	5			
Building six Wells, Agra road, between Scindwa and Ackberpoor..	827	0	5			
Constructing three travellers' Bungalows, Agra road, in Nimar..	867	10	3			
Planting Trees between Malligaum and Chandore Ghaut...	99	10	0			
Constructing three Wells, Agra road, in the vicinity of the Scindwa Ghaut....	180	8	2			
Annual and special repairs to travellers' Bungalows.....	436	12	2			
Constructing a Church at Malligaum..	2,778	3	7			
Constructing a Store-room and Work-shed (Civil Engineer's) at Malligaum....	405	2	8			
Constructing a Ferry Boat for crossing the Mails over the Taptee River....	681	4	6			
Fords and Ghauts.....	170	8	10			
Annual repairs Military Department..	15	11	1			
Emergent repairs to the Military Lines at Dhoolia.....	1,140	9	2			
Blue-washing the Military Detachment Hospital at Dhoolia...	11	0	0	13,114	7	5
Grand Total, Rupees Fifty-four thousand, four hundred and thirty-nine, Annas eleven, and Pies two.....				54,439	11	2

Abstract of the amount Expended during the official year 1846 | 47.

	Rs.	*a.*	*p.*
Works connected with the communications of the Province.....	33,348	12	11
Buildings.....	13,114	7	5
Bhundarras..	7,976	6	10
Grand Total as above Rs....	54,439	11	2

Statement shewing the Expense of Engineering and Superintendence with reference to actual outlay.

Names of Officers, &c.	Expense of Establishment	Expenditure	Rate per cent.
	Rs.		
1st Lieutenant P. L. Hart, Civil Engineer in Khandeish.....	8,351		
2nd Lieutenant M. Kennedy, Assistant Civil Engineer (appointed on Special duty at Asseerghur, left 31st December 1846)..	3,402		
2nd Lieutenant Jones, Assistant Civil Engineer, joined 13th January 1847....	1,522		
2nd Lieutenant Boddam, joined as Acting Assistant Civil Engineer 9th January 1847...	643		
Mr. Assistant Surveyor and Builder T. Price, in charge Assistant Civil Engineer's Office Dhoolia, from 1st May 1846 to 13th January 1847..	1,448		
Four Assistant Surveyors and Builders, including Mr. Price..	4,218		
Detachment Sappers and Miners, their Batta and Working Pay..	634		
Office Establishment from 1st May to 30th November 1846..	4,681		
Total Rs....	24,899	54,439	Nearly 46 Rs.

	Rs.
Expenditure during the official year 1846 | 47.....	54,439
Expense of Civil Engineer's Establishment, including all charges.	24,899

Rate per cen.=45$\frac{4}{5}\frac{9}{4}\frac{4}{3}\frac{5}{3}$ nearly 46 per cent.

Rupees 20,000 increase of per centage over former year.

3. The Expenditure is less this year than that of the former, by upwards of twenty thousand Rupees; the per centage has consequently increased about fifteen per cent. The want of sanctioned works this year has been much felt, and is the principal cause of increase in the per centage; it has also tended, in conjunction with considerable sickness experienced by those engaged on the Cunasse Bhundarra, to partially disorganize the working parties. It is scarcely necessary to mention, that the inhabitants of Khandeish, generally speaking, are somewhat averse to labour, and that almost the whole of the works in the Province are executed by the lower casts of Hindoos from the Deccan. To sustain the efficiency of the working parties, composed of these people, it is necessary to give them constant employment, to have sanctioned works in advance of those that may be in progress, to fall back upon when the others are completed. The average strength of the work-people is about fourteen hundred; it has fallen to about nine hundred, from the causes above-mentioned.

Reason of increase.

The necessity of having sanctioned works always in hand to fall back upon.

Average strength of Khandeish working parties.

Rupees 1,89,276

4. The amount of Estimates submitted to the Superintending Engineer S. P. for Works connected with the Province, is Rupees one Lac, eighty-nine thousand, two hundred and seventy-six.

	Rs.
Constructing a House for the reception of Saw Gins at Dhurungaum.	1,834
Special repairs to the Collector's Bungalow at Dhoolia	240
Emergent repairs to the Military Lines Dhoolia..	1,272
Repairing the Datoortee Bhundarra. . .	8,811
Supplimentary estimate Work-shed and Store-room...	405
Ditto Dunnair Bhundarra.	52
Military Pendalls, Dhoolia..... . . .	16,393
Bheel Lines various parts of Khandeish. .	15,052
Carried forward Rs....	44,059

Brought over Rs....	44,059
Cotton Press House at Dhurrungaum. . .	2,463
Chowdana Bhundarra.	1,502
Kundana Bhundarra.	1,190
Much Mull Bhundarra.	4,192
Solitary Cells, two Native Regiments. . ..	2,326
Supplimentary Estimate Sultana Kutcherry.	568
Bungalow W. Bheel Agent, Nundoorbar...	2,000
Record-room, Chaleesgaum... .. .	903
Remedying insecurity of Cells, Dhoolia Jail.	4,335
Erecting weather frames Dhoolia Jail. .	654
Bridging and draining the Nimar Line, that portion of the Agra road between Scindwa and the Nerbudda.	46,465
Supplimentary Estimate alterations to Centre Guard-room of the Dhoolia Jail.. . .	273
Ditto travellers' Bungalow at (in Nimar) Koorvunpoora..	746
Defences of Pimpulnair Kutcherry.. ..	13,845
Agra Road Kanoolee Nulla Bridge. ..	4,710
Annual repairs Territorial Department.. ..	686
Ditto..... Judicial.... ditto.. ..	666
Ditto..... General.... ditto.. ..	618
Ditto made Roads and Bridges.. ..	13,910
Ditto..... Military Department.. ..	44
Annual and Special repairs Judicial Department..	511 155
Malkurries Kutcherries.....	4,313
Supplimentary Estimate Cunassee Bhundarra	5,152
Wall to surround Work-sheds, &c. Dhoolia Jail	4,505
Dhabarree Patna Bhundarra..	3,748
Modee....ditto.....	2,628
Mandul.....ditto....	1,804
New Court House Dhoolia Jail..	19,332
Doosana Bhundarra...	184
Alterations Malligaum Kutcherry.....	789
Total,...	1,89,276

Abstract of the above Description of Work executed.

Summary of work performed.

Estimates prepared. 52
Plans prepared 37
Number of miles travelled by the Civil Engineer as per written Journal.. . .. 1549

Original duties of the Civil Engineer's Department in Khandeish.

5. The Civil Engineer's Department was, I have generally understood, formed more particularly for the repairs of the numerous valuable works of Irrigation in the Western Districts of the Province. The following Statement will shew to what extent the expenditure has amounted on the different heads of,—1st, Works connected with the communications of the Province;—2nd, Buildings;—and 3rd, Bhundarras, since its formation in 1836 | 37 to the close of the present year 1846 | 47, and whether the original intentions of Government have been carried out or not.

To what extent carried out?

Year.	Works connected with the communications of the Province.	Bhundarras.	Buildings.
	Rs.	Rs.	Rs.
From 1836 | 37 to 1842 | 1843	1,29,070	68,361	18,608
1843 | 1844	32,530	6,302	6,958
1844 | 1845	35,092	14,729	11,159
1845 | 1846	47,353	17,319	13,274
1846 | 1847	33,348	7,976	13,114
Total 11 years....	2,77,393	1,14,687	63,113

Proportion of time occupied in 1st—Buildings, 2d—Bhundarras, 3d—Roads &c.

Taking, then, Buildings at..... 1·0
Bhundarras will be..... .. .. 1·81
Works of communication..... ..... 4·39

and supposing nine hours daily to be devoted,

	H.	M.
Buildings will engage.....	1	15
Bhundarras.....	2	15¾
Works of communication..	5	29¼

6. The Superintendence and attention of the Department, as a general rule, has been and must be directed where the greatest expenditure is; and it is on this general supposition, the foregoing calculation has been based. There can be no doubt of the value of the Irrigation Works: and if this Department was originally formed principally for the purpose of their repairs, by increasing or sustaining the Irrigation, and only (2 H. 15 M.) one quarter of its time devoted to them, it is very clear its use has been somewhat subverted.

As a general rule, most time and attention will be required in those branches of the work where the greatest expenditure is.

Of the works of Irrigation formed; the principal cause of the formation of the Department; and only one-fourth of its time is engaged on them: its use has been somewhat subverted.

7. In several of Captain Scott's (late Civil Engineer) communications, the employment of his time on such miscellaneous Works, to the detriment of the Revenue Works, formed a subject of regret. I beg to express mine on the same account. The value and importance of these Works, I am most fully impressed with, and also with the necessity of some division of labour with regard to them.

Employment of the late Civil Engineer's time on miscellaneous work to the detriment of Revenue Works &c: some division of labour necessary.

8. Of all the miscellaneous Works in Khandeish which engages an unusual portion of time, is the Dhoolia Jail. There appears to me to be no termination to the alterations, additions, and repeated calls for fresh works. Independent of annual repairs, these have amounted, between the years 1844 | 45, 1846 | 47, to the large sum of Rupees twelve thousand seven hundred and sixty-four, viz.

The Dhoolia Jail requiring much time.

Large amount expended in alterations to this building, Rs. 12,764.

	Rs.	*a.*	*p.*
New Drains, Dhoolia Jail.... ..	79	0	0
Work-shed, Dhoolia Jail.... ..	2,040	0	0
Hospital over Guard-room, Dhoolia Jail..	1,888	7	1
Stair and Court House Privy, Dhoolia Jail.....	258	14	0
12 Solitary Cells, Dhoolia Jail.....	5,087	0	0
Carried forward Rs....	9,353	5	1

Brought over Rs....	9,353	5	1
Emergent Repairs temporary Buildings Fort of Malligaum (Prisoners removed out of Dhoolia Jail)	351	14	5
Constructing Ventilators, Dhoolia Jail.	957	0	6
Annual Repairs temporary Buildings Malligaum Fort, (Prisoners remained there)...	176	10	11
Altering centre Guard-room, Dhoolia Jail.....	1,376	7	8
Constructing Urinaries, Dhoolia Jail	549	0	0
Total Rupees....	12,764	6	7

And with the periodical repairs, the amount will be thirteen thousand five hundred and fifty Rupees, annas thirteen, and pie one, viz.

Annual Repairs	1844	45	330	14	1	
Ditto	1845	46	63	8	5	
Ditto	1846	47	392	0	0	
					786	6 6
Expense of alteration as detailed above..					12,764	6 7
Total Rupees....					13,550	13 1

Rupees 13,550.

There are several fresh calls for new works besides the above. It appears to me, that the expenditure of Rupees thirteen thousand five hundred and fifty (13,550) in the course of three years on a finished building, is a very large one; and as due attention has been paid to all sanatory measures in many of these alterations, I would most strongly recommend that nothing further be done to this building not actually and bonâ fide absolutely necessary. I am free myself to confess, that with the unfinished state of the principal line of communication running through the Province, the Agra Road, and the ruinous state of many of the works of Irrigation, it will be a subject of deep regret to me to see

Nothing further should be done to the Dhoolia Jail beyond the necessary periodical repairs.

one single Rupee more expended on this building, containing five or six hundred well-fed human beings, supported entirely by the "State," and contributing nothing whatever towards it than in the usual necessary periodical repairs. I scarcely ever enter this Jail without envying the amount of human power available, which might be made so, for the numerous useful works in this fine Province, and sincerely hope some means may shortly be devised of cheaply working it, and really carrying out a sentence of "Imprisonment with hard labour." Five hundred of these prisoners properly worked on the road, would make it a beautiful line in two or three years.

A pity the Prisoners cannot be made available for the public works of the Province, particularly the Agra line of road.

9. I will now proceed to make a few remarks on the

Works connected with the Communications of the Province.

I. AGRA ROAD.

	M.	F.	Y.
Chandore Ghaut to Scindwa....	116	6	214
Scindwa to the Nerbudda.....	37	0	162
To the Khull Ford of the Nerbudda	3	0	0
	156	7	156

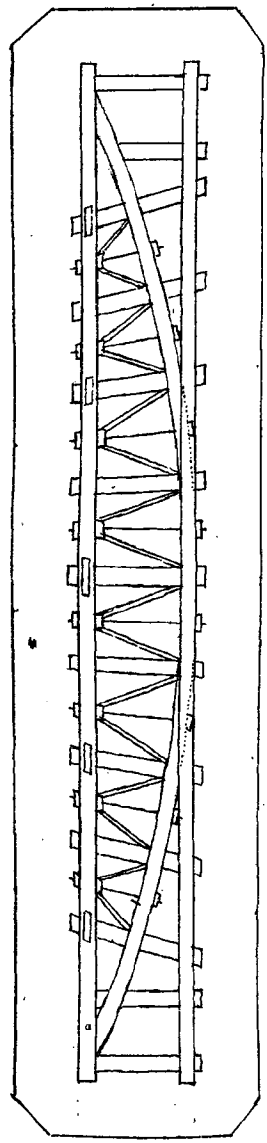
Chandore Ghaut to Malligaum.—156M. 7F. 156YS.

No. 1. Wakee Nulla Bridge.

During the past official year, the Wakee Nulla Bridge, commenced the former year, has been completed. It consists of a semi-elliptical rubble masonry arch, of 30 feet span, and 8 feet rise, with two side semi-circular arches of 5 feet span each. The work throughout is constructed of rubble masonry, on a pitched foundation of the same. A second bridge has been constructed across a branch of the same large nulla, called the second Wakee Bridge. It is composed of two wooden trusses, each 54 feet in length, firmly fixed in rubble masonry abutments, the road being laid on the lower beams of the trusses. It has a waterway of 46 feet in the clear, the

No 2. Wakee Nulla Bridge.

road crossing the nulla somewhat obliquely. The trusses are composed of pieces of teak, none exceeding 10 feet in length, taken out of the ruinous buildings in the Fort of Malligaum. The subjoined figure will give an idea of one of the trusses, and I hope to be able to give a more detailed account of this work in the Appendix annexed to this Report.



Between Malligaum and Dhoolia.

Wulwarree Nulla Bridge.

10. A rubble masonry bridge has also been constructed over a bad nulla (Wulwarree Nulla,) between the Town of Malligaum and the Village of Dherryghaum, consisting of two semi-elliptical arches of 18 feet span, and a rise of 1 foot each, constructed on a pitched rubble masonry bottom. An oblique or skew bridge has been commenced, to cross the Kanolee Nulla near Chickulwall, of two semi-elliptical arches, 24 feet span, and a rise of 7 feet each, also on a pitched rubble masonry foundation. The arches have been constructed and centering struck, and the work about two-thirds finished.

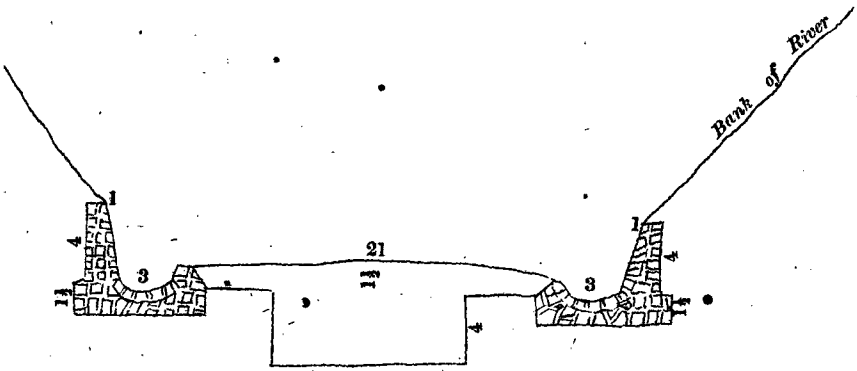
Kanolee Nulla Bridge.

Between Dhoolia and Sirpoor.

Approach of north bank of the Taptee River.

11. The approach on the north bank of the Taptee has been completed. The approach on the south side, of a similar description, is very nearly finished. The section below will give some idea of the section of this road carried to the bed of the river through very high banks. I fear I shall not be able, with this Report, to give an account of this work; I will, however, endeavour to do so, and should I be able, it will be found in the Appendix annexed.

Approach of south bank of the Taptee River.



Between Sirpoor and Scindwa.

12. Nothing has been done to this portion, beyond the usual periodical repairs.

Between Scindwa and the Nerbudda.

Nimar Line.

13. This portion of the Agra road, called the Nimar Line, has not been touched since it was cleared by Captain Ottley, a large balance remaining unexpended of the original sanction. Plans and Estimates have been submitted for bridging and draining the line, with a viewing of appropriating such, as far as it will go, to so useful an end.

Plans and Estimates submitted for bridging the Nimar Line.

General State.

General state of the Agra road.

14. As regards the general state of this highly important line, extending from the Chandore Ghaut to the Nerbudda, 156 M. 7 F. and 156 YS. from this ghaut, Soangeer may be pronounced a good moorum road. From Soangeer to the Nerbudda, as a whole, may be considered as very little better than a cleared track, of course varying in quality. There are no impediments in any part of the line to fair weather traffic; the slopes of all the ghauts are good, and the banks of the nullas cut down. I am now engaged in gradually overcoming the smaller impediments, such as constructing nullas and bridges of a small description where most required, in regular succession, and generally improving the road level; this once effected, the road can be made either moorum or metalled, as may be required.

II. *Rawere and Dhurungaum Road.—54 Miles.*

Rawere and Dhurungaum road.

15. This is a fair weather road, passing mostly over black soil: it crosses the Taptee and Geerna, both large rivers, with very high banks. During the fair weather, the road is as good as could be desired for fair weather traffic; and all that it at present requires are a few bridges and drains.

Bridges and drains required to this line.

III. *Joregah and Nusseerabad Road.—63 Miles.*

Joregah and Nusseerabad road.

16. This is also a fair weather road, and running somewhat parallel to the Boree and Geerna rivers, crosses in a measure the drainage of the Country. Without bridges and drains, it is in many parts quite useless; long detours have to be made to avoid the numerous nullas. Plans and Estimates, prepared by Captain Ottley, were submitted by me, and a reference was made on the subject of sanctioning them about a year and a half ago.

Bridges and drains very much required to this line.

Have been under reference a year and a half.

IV. *Malligaum and Surat Road.*

Malligaum and Surat road.

17. This line of road never appears to have received any regular repairs by this Department, as a line of road. Captain Scott repaired one or two small Ghauts on it. It was made by the Pioneer Corps upwards of twenty years ago. The slopes of the ghauts are all bad, and the largest ghaut on the line, the Koondaibharree, between Dhywell and Beesurwarree, is in some parts 1 in 5. A detailed report on this line, and some others, to Surat, was made by me in July 1846. The sickness of the Surveyor employed on the survey of the Koondaibharree ghaut, which compelled him to proceed to the coast on medical certificate, has much delayed this project, which, however, I hope will be shortly ready. A new line down this ghaut is very much required.

No repairs executed by this Department to it.

Greatest impediment on the line the Koondaibharree ghaut, slope 1 in 5.

Reason of delay in the survey of this ghaut.

V. *Observations on the principal Lines of Communication in Khandeish.*

Lines of communication in Khandiesh generally.

18. A sketch Map of the present lines of road in Khandeish, and these most required, accompanies this Report. The principal expenditure on these works has been on the Agra Road. I think the junction of the Rawere and Dhurungaum Road with Dhoolia would be very beneficial, and complete the communication with the Eastern Districts. From Dhoolia the road might be taken with much benefit by Keir, Neir, and Sawkay, to Goreda, and there cut into the Malligaum and Surat Road, a few miles from Dhywell. The Koondaibharree Ghaut being at the same time put in an efficient state, would render the communication between the Eastern Districts of the Province and the coast complete. The Koondaibharree Ghaut Road has been surveyed, and the plan and estinate will be shortly submitted; it should be constructed in a permanent manner—the other lines might merely be cleared. With respect to the roads in the Western Districts, many of the barrees or passes are scarcely traversable for carts. The direct road from the

Communication between the coast and Eastern Districts.

Roads in the Western Districts. The Barrees or passes in very bad order.

richest parts of these districts is by the Kunchunbarree Ghaut to Nassick. This ghaut was put in repair by Captain Scott, and the following barrees intercepting the various lines of communication between the valleys of the Geerna-Arrum and tributaries, Moosin Panjur Kace and Borai Rivers, require to be put in an efficient state to complete the lines. A good cart road running North and South through the Western Districts, including the easy passages of all these barrees in its line, would be of great utility. The road at present between Dhywell and Nundoorbar is particularly painful, while the one between Sankay and Zeytana, by the Gutbaree, is terrible.

Barrees requiring to be put in efficient order.

Road between Dhywell and Nundoorbar very bad.

Do. between Sankay and Zeytana.

1. Between Baze and Suttana—Hutroa Barree.
2. Between Suttana and Zeykheira—Doll Barree.
3. Between Zeykheira and Pimpulnair—Sail Barree.
4. Between Sankay and Zeytana—Gut Barree.

There is also another one between Zeykheira and Pimpulnair, which I am not acquainted with,—the Pessol Barree, repaired by Captain Scott. The above, I think, are the ones which first require attention. The first is in very good order, but the others, particularly the Sail Barree, one of the most used, is particularly bad.

Sail Barree very bad.

19. The roads over these passes generally follow the water-courses over sheet rock and up steep rocky banks, and require to be constructed in the most permanent way, and great attention paid to the drainage. The allowance of 100 Rupees for each ghaut and ford is totally inadequate for works of such magnitude. If merely cleared, in the worst places, of detached stones and baildars, the next season after heavy rain finds the work in as bad a state as before. The lines over these hills require to be most judiciously chosen; and as detailed Plans and Surveys would be required, and such documents occupy much time, putting these works in an efficient state must be a work of time. My attention, however, should leisure permit, shall be directed

Roads over these hills require to be constructed in a permanent manner.

100 Rupees allowance quite inadequate.

to the Sail Barree, the worst and most used, over which a new line would be required.

VI. *Bhundarras.*

Bhundarras.

20. A separate Report on these works accompanies this, agreeably to the 11th para. of Mr. Pringle's Letter, No. 1817 of 1847, to the Revenue Commissioner, bearing his endorsement, No. 801 of 1847.

VII. *Buildings.*

Buildings.

21. With respect to the works constructed under this head, nothing worthy of remark has been executed. However, while on the subject of Buildings, I beg to submit a few remarks on the subject of day-labour, particularly relating to artificers, such as Goundies, Carpenters, Stone-cutters, and others. Task-work, to a certain extent, is in use amongst the common labourers. The system of paying artificers by the day, instead of the work performed, abounds with defects, encouraging uncompromising idleness on the part of the artificers, and with fraud to the employer. It is productive of much evil, placing the Engineer completely at the mercy of his work-people, and reducing his estimated amount of labour to a nullity. In all countries, and amongst the Natives themselves, a system of day-labour is never followed, and all are paid by some local standard measurement; and where measurement cannot be applied, in very few instances, by job work. There can be no doubt, to a hard working man, pay by work and not by day is as great a benefit as to his employers. In this Province especially, where living is generally so cheap,—one day's work keeping a man for four, the evil is particularly felt—continual employment is no object; and during a month, I have scarcely ever found either an artificer or common labourer work twenty days out: on Sundays there is, of course, no work done, and they are not counted.

Remarks on day-labour.

The introduction of a system of payment for work performed instead of per day quite impossible to the Engineer.

Assistance of Government required.

22. To introduce a system of payment to artificers for measured works, would be quite impossible to the Engineer Officer with common labourers. As I before mentioned, task-work, to a certain extent, is in force; but to the former, the incitement to irresponsible idleness is too great: if done at all, the assistance of Government would be required; to what extent it might be considered expedient to give such assistance, if at all, I cannot say, but very probably it might be left still to competition, which generally (as far as my experience goes) resolves itself into combination. I merely introduce the subject, as the Engineer whose duty it is to exact a proper degree of work from all work-people in Government employ under him, and I see no other system but of payment for work performed. If a certain number of artificers are employed who are idle half the day, Government is swindled half the amount: supposing their pay to be cut, they leave the work. I must confess myself, under the present system of day-labour, it is most difficult, I may add almost impossible, to obtain a proper degree of work. There is, of course, but one remedy at present, which is the contract system: however, in this Province such a system does not obtain, and no one comes forward. On one or two occasions, common Banians have taken contracts for repairs, and of course, such people being perfectly unacquainted with such work, the result has always been most unsatisfactory. Even supposing high rates at first to prevail for measured work, the benefits resulting would be incalculable; at any rate, you would know exactly what you would get for your money, which at present you are perfectly ignorant of.

Under the present system of day-labour, impossible to obtain a proper portion of work from the artificers.

VIII. *Establishments.*

23. The following alterations have taken place in the Department since last Report.

On Lieutenant Hill, Assistant Civil Engineer, leaving in February 1846, Mr. Price, Assistant Surveyor and

Builder, took charge of his duties, which he performed very satisfactorily to the 13th January 1847, when Second Lieut. Jones being apppointed, relieved Mr. Price. Lieut. Kennedy, Assistant Civil Engineer, was detached to Asseerghur on special duty, 1st January 1847, and Lieut. Boddam joined as Acting Assistant Civil Engineer, 9th January 1847. Such changes are, of course, very detrimental. The two young officers lately joined—Lieuts. Jones and Boddam,—having been out only a few months in the country when they were appointed, could have had no experience whatever, having to learn their duty before they could be of any material service. I have every reason to be pleased with their efforts.

Native Surveyors.

24. During the last season, I have had every reason to be pleased with these subordinates, particularly Luximon Ramchunder, No. 71, who was entrusted with the execution of a very difficult and important work—the Cunâssee Bhundarra, which he did much to my satisfaction. Since Mr. Thomas Price, No. 46, joined my Office from being in charge of Lieut. Hill's duties, I cannot say he has exhibited his usual zeal and industry. Narrayen Witul, No. 45, having caught a bad fever in the Survey of the Koondaibharree Ghaut, was obliged to proceed to the Coast for his health on medical certificate; I was therefore deprived of his services during some of the most important months of the working season. Native Surveyors.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. HART, Lieut.

Civil Engineer.

Malligaum, Civil Engineer's Office, 17th August 1847.

APPENDIX

TO

ANNUAL REPORT

IN THE

GENERAL DEPARTMENT,

FOR THE YEAR 1846 | 47.

TOOLS.

Tools generally procurable from the Arsenal not well adapted to heavy works.

Most of the tools generally procurable from the Arsenal at the Presidency or out-stations, being particularly unfit for large Works, in which there are deep cuttings through Moorum or Rock, and other descriptions of heavy work, I have annexed a rough sketch of nine different sorts of the most useful tools, with a short description of each attached.

Musters have been made up by the Civil Engineer.

Musters have been made up, which I shall be happy to submit, should the subject be deemed of sufficient importance.

Something very defective in the Pick-axes.

The Pick-axes usually supplied invariably break at the eye, when the other parts of the tool are in excellent order. I think, were the Kodallee No. 4 more generally substituted for this tool, with a strong circular eye for the handle, it would be attended with much advantage to the laborer and his work, and also be found in point of breakages and repairs much more economical.

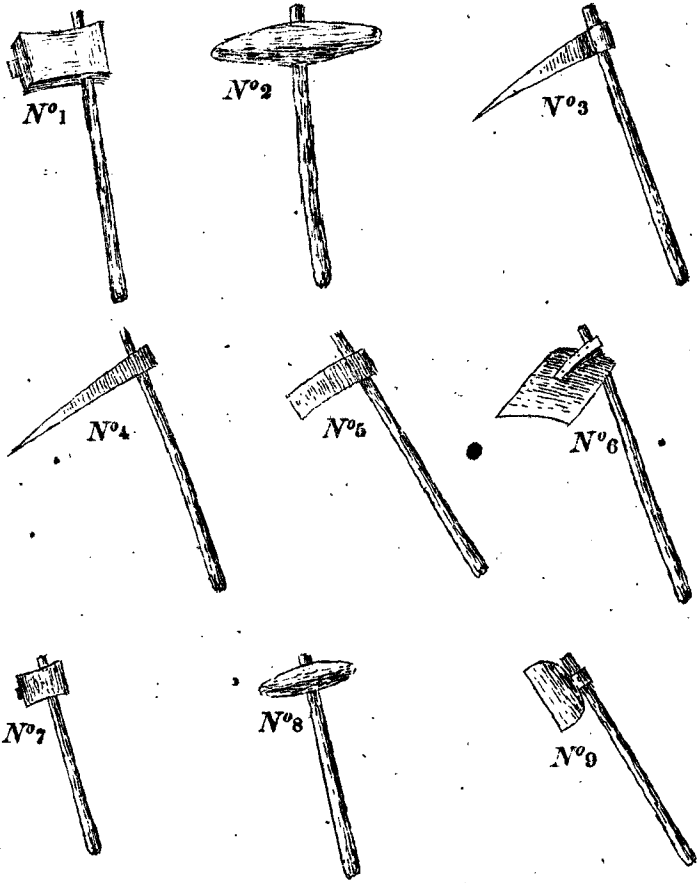
Better substitute for the Pick-axe generally the Koodalee.

Numbers 1, 2, 3, and 7, are particularly useful tools.

Phaoras issued too heavy.

The common Phaora is No. 6. I think those issued generally too heavy. I have seen but two sorts—the large and small ; the former is far too heavy a tool altogether, and the latter is too heavy and long in the blade for its size. A strong eye and shank is required, with a somewhat light, broad, and shallow blade riveted on.

No.	Names.	Description.
1	Sootkee.....	This is a large heavy description of Sledge Hammer, with a steel Tongue (Butt) for squaring large stones in the Quarry, and reducing them to a tolerably square form for the stone-cutter. Its weight is lbs.17¼.
2	Do. or Gun.....	A description of Sledge Hammer of an oblong form for breaking stones in the Quarry; particularly useful in detaching pavements loosened by blasts, very useful in cuttings in rock, in excavating wells, &c. Its weight is lbs.19½.
3	Soomba.....	A thick round heavy species of Kodalee; very useful in excavating in rock and hard moorum, loosening stone cracked by blasts, &c. Its weight is lbs.12½.
4	Kodalee.....	The common native Pick-axe,—a very useful tool in excavations of all sorts; a much stronger and more economical tool than the Pick-axe—not so liable to break. Its weight is lbs.7.
5	Felling axe or Koorar.	Narrower and thicker than the English one—more adapted to the strength of a Native. The eye, in which the handle is fixed in, is round, very easy to re-handle; the English one is very difficult to re-handle, and is too heavy for this country. The eye being triangular, is a great objection unless a carpenter is at hand. Its weight is lbs. 6.
6	Phaora.....	This is the common Phaora; broader in the blade, shallower, and not so heavy as those usually supplied. Its weight is lbs.7½.
7	Small Sootkee.....	This is a small Sootkee (See No. 1), or Goundies Hammer, with the steel Butt for dressing stones: in all rubble masonry work this is a most useful tool, and one much required. Its weight is lbs.3¾.
8	Hammer.....	A Hand-hammer for breaking metal for roads. Its weight is lbs.2¼.
9	Hand Hatchet or Phursee.....	A small Hatchet for clearing low jungles: a very useful tool. Its weight is lbs.3.



	WEIGHT.
No. 1. Sootkee, or Sledge Hammer.....	17¼ lbs.
No. 2. Ditto... or Gun.... do.....	19½
No. 3. Soomba, or another description of Hammer.....	12½
No. 4. Kodalee, or Native Pick-axe.....	7
No. 5. Koorar, or Felling-axe.....	6
No. 6. Phaora, or Native Hoe.....	7¼
No. 7. Small Sootkee, or Goundees Hammer.....	3¾
No. 8. Hammer.....	2¼
No. 9. Hand Hatchet.....	3

BRIDGES.

In the hope that detailed Plans and cost of this useful description of Works, Road Bridges, actually executed, may prove generally useful, I beg to transmit, with the Annual Report in the General Department for 1846 | 47, the following Plans of Bridges executed on the Agra Road, with a short description of each.

Plan No. 19, 1847 | 48. Details of the Trussed Wooden Bridge constructed across the Wakee Nulla, No. 2, S. of Malligaum.

Plan No. 20, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Wakee Nulla, No. 1, S. of Malligaum.

Plan No. 21, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Moongsa Nulla, S. of Malligaum.

Plan No. 22, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Wulwarree Nulla, N. of Malligaum.

Plan No. 23, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Choukey Nulla, N. of Malligaum.

Plan No. 24, 1847 | 48. Details of a small Viaduct erected near Sirpoor, N. of Malligaum.

Plan No. 19 of 1847 | 48.

Description of the Trussed Bridge across WAKEE NULLA, No. 2.

Wakee Nulla Bridge No. 2.

This Bridge is composed of two vertical trussed frames, formed of pieces of teak, none exceeding 10 feet in length.

Composed of vertical trussed frames

The general scantling of the principal timbers is 10″ × 4″. These frames rest 4′ on each end of the abutments of the bridge, and are supported at the ends by a wooden corbal and shut, projecting 2′ beyond the face of the abutment, leaving a clear waterway of 46 feet. The timbers of which these frames are composed, were carefully fitted together at the workshop, taken to pieces and carted to the spot a few paces from where the bridge was building, again fitted together about sixty paces from the Nulla across which a good scaffolding had previously been erected, and there brought into close contact, and securely bolted and stopped together.

Trussed frames completed.

The truss being completed, was lifted by one hundred Bigarries, carried to the scaffolding, and laid on its side, from which it was raised to a vertical position in its proper place. The same process was pursued with the other trussed frame. No bolt was driven or fixed after it had been placed in its position, nor even on the scaffolding before raising it to the vertical position.

How placed in position.

Roadway joists.

The roadway joists or floor timbers were placed as nearly at right angles as possible to the sides of the trusses; the road crossing the Nulla obliquely at each end, they partly rest on the abutment and partly on the stringer. These joists were only slightly knotched down in some places, and laid without any fastening on the upper side of the string pieces. They are teak logs in the rough, about 14′ long × 7½″ × 8″, laid at about 2 feet apart.

Not fastened to stringers.

Wooden arches.

This trussed frame is composed of a pair of string pieces, with a pair of wooden arches (rod 70), each arch being composed of five pieces of teak 10″ × 4″. The ends of the arches are knotched down to the ends of the stringer, and fastened there by two iron straps at each end, and one screw-bolt to each framing between the two straps. These straps embrace the ends of both stringers, there being a screw-bolt, as before remarked, to each framing.

Radiating posts.

To each truss, composed of a pair of framings, there are eleven radiating posts passing between the two framings, and each bolted through the stringers and arches by eight screw-bolts, four through the stringers, and four through the arches. The posts are single, and the stringers and arches of the framings are fastened in pairs upon their sides by the screw-bolts, as before mentioned. These posts project four inches below the under side of the stringers.

Railing.

The radiating posts are carried up to a level with the top of the arches, and firmly kept in their places by horizontal pieces in pairs bolted through the heads of the posts. Besides the eleven radiating posts, there are ten other vertical ones, one at each end of the framing in the masonry.

Vertical posts.

The pieces of teak being only 10 feet in length, scarfing was necessary, which was effected by bringing the squared end of the timbers together, and bolting iron bars along their sides, a block of wood, the thickness of the radiating posts, being inserted at the places of scarfing. By transposing the position of the timbers of one of the framings, no two joints come in the same place—both those of the string pieces and arches are broken. There is not a mortise or tenon in the trussed framing.

Joints of framing broken.

Bolting blocks.

Bolting-blocks were also inserted between the ends of the stringers forming solid masses to bolt through.

Stiffening the framing.

To stiffen the trussed framing when the string pieces, arches, and radiating posts were all bolted together,

short transverse blocks of wood, of a triangular shape, were let into the upper side of the stringers, extending over both to the depth of about half an inch; on the sides of these blocks, small struts, each 3″ × 3″, were fitted on (no tenon), the upper ends of these struts being let into the radiating posts near the lower edge of the arches. A similar block, of a more oblong shape, was also fitted on to the upper sides of the arches extending over the pair of framings, and a corresponding one on the lower side of the string pieces through these three. Round iron 1½″ suspending bolts were passed and screwed up on the lower end by a nut and washer to the lowermost block. The whole framing is much stiffened and strengthened by these suspending bolts and struts, at an expense of a comparatively small quantity of materials. In 54 feet, the string pieces were cambered 6″.

How?

The truss frames are separated by a distance of 12 feet. The flooring of the bridge is composed of round teak rafters (goals) about 3″ diameter each, placed close to one another, and well nailed down to the flooring beams or roadway joists. There is also a side plank, to retain the road material, nailed on the inside of each truss to the radiating posts.

Distance between truss frame.

Flooring.

Side planks.

The timber used in this bridge is teak throughout, rescued from rotting in the ruinous native buildings in the Fort of Malligaum. The roadway joists were furnished from the Work-yard. The flooring was also procured from the Fort, and appears to have been used for flat roofs of the native buildings. The wood is very brittle from its great age, supposed to be about one hundred years old, or I should have reduced the scantling from 10″ × 4″ to 10″ × 2½″ or 3″.

Timber.

Scantling of timber.

The general construction of this work is as follows: viz.

Foundation—Filled in of uncoursed rubble masonry. No pitched foundation.

Abutments—Sides and ends of coursed rubble masonry.

Parapet wall—Of coursed rubble masonry coped with single stones laid transversely across the wall. Third sort cutting.

Embankment—Of stiff clay and moorum with sand.

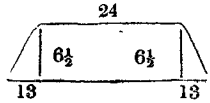
Embankment.

The embankment on the S. approach is about 530 feet long, filled in to an average height of $6\frac{1}{2}$ feet: that in the N. approach is 500 feet long, filled in to an average height of $6\frac{1}{2}$ feet.

Cost.

The total cost of this work, including embanking, was Rupees four thousand one hundred and twenty; and the cost of the different portions of the work may be roughly taken as follows, viz.

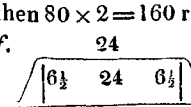
Cost of different portions.

	Rs.	*a.*	*p.*
Total expense of trusses and roadway, including Carpenters' work, nails, iron, &c. &c.....	750	3	7
15,959 cubic feet of rubble masonry, including every thing at 12 Rs. per 100 cubic feet.....	1,915	1	3
 1030 running feet of embankment = 2477·15, at eight annas per 100 cubic feet*	1,238	9	2
Sundries, including scaffolding, excavating foundation, &c.....	216	2	0
Total Rs....	4,120	0	0

*Running ft. of abutment=80′—then $80 \times 2 = 160$ running ft.

Then $160' \times 19' \times 4\frac{1}{4} = 12920$ *c.f.*

Wall protecting road $48' \times 3\frac{1}{2} \times 14\frac{1}{2} =$	2436
Parapet Wall $138' \times 1\frac{1}{4} \times 3\frac{1}{2} =$.....	603
	15959



$13 \times \frac{6\frac{1}{2}}{2} = 42{\cdot}25$

$13 \times \frac{6\frac{1}{2}}{2} = 42{\cdot}25$

$24 \times 6\frac{1}{2} = 156\ 0$

$\therefore 240{\cdot}5 \times 1030 = c.ft.$ 2477·15 / 240·5

Tarring.

All the wood-work received three coats of tar. The moorum at the sides of the road is 4″ deep, and 2″ of good broken metal over it; and in the centre of the road, 8″ moorum, and 4″ metal.

No. 20 of 1847-48.

Description of the Rubble Masonry Bridge constructed across the

WAKEE NULLA, No. 1.

Wakee Nulla No. 1.

This bridge consists of a semi-elliptical arch, of 30 feet span, with a rise of 8 feet, and two side semi-circular arches, of 5 feet span each. The breadth of the roadway between the parapets is 18 feet. The roadway is embanked on the N. side 250 feet in length, and on the S. side 450 feet, at an average height of 5½ or 6 feet. Dry rubble stone walls retain this embankment the whole of the above distance.

The foundation of this bridge, composed of uncoursed rubble masonry, is carried down 2 feet to hard moorum and rock. The arch is of hammer-dressed rubble masonry throughout, and the other portions of the work are of coursed rubble masonry. The parapet wall is 3½ feet high, and the length of parapet, from end to end, 71 feet: the top is coped with choonam plaster. The waterway of the large arch was afterwards paved with rubble stone and choonam, the original foundation being carried under the side arches.

The details of this bridge are most clearly shewn on the Plan accompanying.

Total cost, including the approaches, was Rupees three thousand seven hundred and forty-four, annas five, and pies six. Rs. 3,744 5 6.

No. 21 of 1847–48.

Description of the Rubble Masonry Bridge constructed over the

MOONGSA NULLA.

Moongsa Nulla.

This bridge has two segmental arches of 15 feet span each, and rise five feet. Throughout, the construction is of rubble masonry, with a coping of choonan plaster to the parapet wall. The waterways are roughly paved with dry rubble.

This bridge was constructed about the middle of an embanked portion of the Agra Road, near Moongsa. The walls shewn in the Plan adjoining the wings, were found necessary, to preserve a closer connection with the raised portion of the road. The approaches were filled in, about 60′ in length at each end of the bridge, to an average depth of $5\frac{1}{2}$ or 6 feet.

The whole drainage of this part of the country finds its vent through this bridge. In the heavy falls of rain at the commencement of the monsoon, the embankment has hitherto been always injured more or less; this bridge is, therefore, not a sufficient outlet for the water, and two or three large drains through the embankment, with a low wall on the exposed side, are required to give a more free outlet to the water, and to protect the foot of it.

Rs. 1,232 13 10 The actual cost of this work was Rupees one thousand two hundred and thirty-two, annas thirteen, and pies ten,

Rs. 1,300 0 0 and the estimated amount Rupees thirteen hundred.

No. 22 of 1847–48.

Description of the Rubble Masonry Bridge constructed across the WULWARREE NULLA.

Wulwarree Nulla.

This bridge is composed of two semi-elliptical arches, of 13 feet span each, and 6 feet rise. The breadth of the roadway between the parapets is 18 feet, and length of the parapet, from end to end, 60 feet. The roadway is 22 feet broad, and embanked on the N. side of the bridge 420 feet in length, and on the S. side 530 feet, and an average height of 5½ feet. There is no dry stone retaining wall. On the up-stream side are two dwarf walls, about 6 feet high, to protect the junction of the embankment with the bridge in heavy floods.

This work throughout is constructed on a pitched foundation of uncoursed rubble masonry to a depth of 4 feet. The remaining portions of the work are of coursed rubble masonry arches, of hammer-dressed rubble masonry. The parapet wall is coped with cut stone, 3rd sort.

The cost of this work was Rupees three thousand and four, annas ten, and pies eight, including the approaches. Rs. 3,004 10 8

No. 23 of 1847–48.

Description of the Rubble Masonry Bridge across the CHOWKEY NULLA.

Chowkey Nulla.

This bridge has two semi-elliptical arches, of fifteen feet span each, and 6 feet rise. The breadth between the parapets is 18 feet, and length of parapet, from end to end, about 50 feet. The superstructure rests on a pitched rubble masonry foundation, with inverted arches extending from the abutments to the pier. The approaches are scarcely of any length, the banks of the nulla being rather steep. The foundation is of uncoursed rubble masonry, arches of hammer-dressed and other portions of coursed rubble masonry. The parapet is coped with choonam plaster.

Rs. 1,142 4 3

Rs. 1,959 0 0

The cost of this bridge was Rupees one thousand one hundred and forty-two, annas four, and pies three, and the estimated amount Rupees one thousand nine hundred and fifty-nine. The pincipal cause of this great difference was a quantity of rubble stone on the spot, which appeared to have belonged to a former structure: the approaches also being well raised, but little filling in was required.

No. 24 of 1847–48.

Description of a small Viaduct constructed near SIRPOOR.

Sirpoor viaduct.

This little viaduct is constructed over a deep gullee, crossing the Agra Road near Sirpoor, along which a road runs to an adjacent village. It consists of one segmental arch, 14 feet span, having a rise of four feet. It is 14 feet between the parapets. Almost the whole of this work is constructed of brick, excepting a small portion of the filling in of the abutment and wing walls, which is composed of a sort of coarse concrete, made by mixing up large pebbles procured from a neighbouring nulla with choonam. Stone is not procurable for miles round.

The cost was Rupees five hundred and twenty-six, annas eleven, and pies nine, the estimated amount being six hundred and twenty-nine.

Rs. 526 11 9

Rs. 629 0 0

(Signed) P. L. HART, Lieut.

Civil Engineer Khandeish.

No. 704 of 1847.

To,

THE COLLECTOR OF KHANDEISH,
DHOOLIA.

Sir,

1. I have the honor to submit my Annual Report in the Territorial Department, for the official year 1846 | 47.

2. The Works executed or in hand during the past year are as follows :—

Names of Works.	Amount.		
	Rs.	A.	P.
Lenekheira Bhundarra.....	329	11	0
Cunassee Ditto	7338	4	9
Patoonde Ditto	398	7	1
Total amount expended....	7976	6	10

Lenekheira Bhundarra.

Rs. 239 11 0 3. The amount expended on this work has gone towards the improvement of the water-course which, running along the banks of the River for some distance, is very liable to injury in the heavy floods during the monsoon.

Cunassee Bhundarra.

Rs. 7,338 4 9 This amount nearly completed one of the largest works of the sort yet executed in Khandeish. It will pay Government from ten to twelve per cent.

Patoonde Bhundarra.

The amount expended on this work was for some slight repairs. No return may be expected from the outlay, as from the usual want of water in the River and the extent to which deposit has accumulated behind the Bhundarra, no great benefit can ever be expected from this dam in its present state. Rs. 398 7 1

4. It will be seen from the foregoing, that the portion of work executed in this Department is very small, alone arising from a want of sanctioned works: and I beg to call your particular attention to the 5th para. of my Annual Report in the General Department which shews, that under the supposition of the Engineer Department in Khandeish having been originally formed for the repairs of the Revenue works, taking the expenditure for the last eleven years from the formation of the Department, the following proportion of expenditure on the Public Works of the Province has existed. The time and attention of the Department has of course been relative to the expenditure.

Supposing building taken at 1
Bhundarra will be ..... 1·81
and works of communication ..... 4·39

5. During the period I have held the appointment of Civil Engineer in Khandeish, I have been very dubious of the actual advantages derived from the repairs of many of these works. There can be no doubt of the old works having paid themselves over and over again; but of several large expenditures for repairs and improvements, although present revenue may have been sustained, still the extra revenue derived has been in some cases rather unsatisfactory, and in such results I have been inclined to look for other causes than a want of attention and exertion as relate to these works in the Engineer Department. My predecessor, Captain Scott, received high testimonials of his assiduity and exertion; and

the Hon'ble the Governor in Council was pleased to state, that the quantity of work performed by me was highly creditable.

6. With a wish of obtaining all the information in my power relating to these works in connection with the assessment, &c. of the irrigated land, I requested you would do me the favor of sending me any Records for perusal bearing on the subject; to which you replied, "you regretted you could not comply with my request." I then addressed you a letter containing fifteen or twenty queries relative to the subjects on which I wished to acquire information, to which I received no answer. Your time and attention, I have no doubt, must have been taken up with weightier matters connected with the Collectorate. I trust, therefore, in perusing this Report, you will make due allowances for any want of knowledge likely to betray itself, as far as details go, if not generally of a subject on which I am about to offer a few remarks.

7. It appears to any one who has traversed the Western Districts of the Province, that the cultivation of Sugar Cane is the all in all of the koonbee, in fact that it is pushed to extremes. I suppose because it is cultivated under favorable terms of assessment, and is the commodity of the highest commercial value, that the cultivation of Sugar Cane in these districts has wonderfully increased of late years; there can be no doubt the same remarks may apply also to Rice: the steady fall of the prices of both almost attest the fact, that both crops must have been pushed to extremes. Formerly I believe the crops, or the land according to the crop, were assessed, and the rates on Sugar Cane more than averaged thirty Rupees (30 Rs.) a beega: Rice yielded somewhere about fifteen (15 Rs.), there being two or three rates. The rates now are all equalized on the land, and no matter how much water the crop consumes, whether Sugar Cane, Rice, or Wheat and Kirkool, they all average somewhere about eleven Rupees (11 Rs.) per beega.

8. The subject of assessing the *land* instead of the *crop* (the land according to the species of the crop), has of course been determined, after long experience, by the District Officers, who have brought much knowledge to bear on the subject; however, it does not appear clear to me, that such should obtain with reference to this description of irrigation: as an owner of a Bhundarra, it would appear to me a fairer measure assessing the land according to the quantity of water I supplied it with. In the consideration of this subject the land does not appear to me to be the first object of consideration. If I, as a private individual, make a large outlay by erecting a dam across a river, and have always a large supply of water on hand ready for agricultural purposes, the person who uses most of my water should pay the most. Whether this case at all applies as far as Government is concerned, I leave to you. But as regards the effects on the Engineer Department more particularly, my present objections would certainly apply, if their efforts are to be at all measured by the number of beegas irrigated.

9. I conceive all the Engineer's labors in connection with these Works should finally tend to produce an ample supply of water throughout the year for irrigation. When the lands reverted to Government (formerly, in all probability, given in *enam* to those who built or repaired these Works) the most water-consuming crops, as Sugar Cane, paid the highest rate of assessment, and the other crops in proportion. No doubt all the rates were unusually high, but as long as the most time and water-consuming crops are pushed into extremes, which they are by the fixed rates, so long will the exertions of the Engineer Department in the repairs and improvements of these works appear in an unfavourable light.

10. With reference to the subject (and a very important one it appears to me) of the great decrease of irrigated land (see Mr. Pringle's Jumma Bundee Report, dated 31st October 1841, No. 433) in connection with these

works having fallen off by about one half in extent, from 22,277 beegas to 11,875, there are various reasons to be assigned, amongst which is a very prominent one, that so much rain does not now fall as formerly : and without the necessity of any meteorological observations to prove this, one can scarcely travel over any part of the Province without meeting with ruined Bhundarras frequently across inconsiderable looking streams which now never have a drop of water in them : there are other reasons no doubt for this decrease of cultivated bagayet land, but it appears to me, whether water be abundant or not, it must go on decreasing in extent as long as time and water-consuming crops are pushed to extremes in a thinly-populated district, and neither the liberal sanctions of Government on these works nor the exertions of the Engineer Department will stop it.

11. In conclusion, I should have much wished had I remained in Khandeish to have mastered this subject of assessment, so far as it concerned the Engineer in the repairs and improvements of the works of irrigation; and my present conviction is, that if the utility of the Department is to be measured by the number of beegas under irrigation, the value of it must appear in any but a favourable light. All the efforts of the Engineer should tend to produce an unfailing supply of water; and if a water-consuming crop is assessed at the same rate as others, while requiring five times the amount of water, his exertions are to a great extent gone, and the cultivation of an article forced while the decrease of irrigated land will progress. Until I can obtain better information on the subject, it certainly appears to me, unless a crop is so far taxed with reference to the quantity of water it consumes, not the quantity of the land, the Bhundarra which supplies the water is not done justice to. To repeat this subject :—if a beega of A, requiring five times as much water as a beega of B, C, or D, pays only the same rate of assessment, a fair return is not made to the work supplying the water; the irrigation by so large

an expenditure of water on one description of beega A must decrease, and the commodity A forced to extremes, which I humbly conceive to be the existing case in Khandeish with respect to Sugar Cane and Rice, particularly the former.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) P. L. HART, Lieut.

Civil Engineer Khandeish.

Malligaum, Civil Engineer's Office, 17th August 1847.

"True copy."

(Signed) P. L. HART, Lieut.

Civil Engineer Khandeish.

No. 969 OF 1847.

To,

E. H. TOWNSEND, ESQ.,

REVENUE COMMISSIONER, S. D.

Poona.

SIR,

Handing up Report of Expenditure.

I have the honor to submit the following Report of the Proceedings of the Road and Tank Department for the official year 1846 | 47, with a Statement appended of Works performed, shewing a total expenditure of Rupees three lacks, fourteen thousand, seven hundred and ninety-five, and an average charge for Superintendence of Rupees eighteen and five-eighths.

Rs. 3,14,795.

Rs. 18 and five-eighths.

Cost of Superintendence.

2. The mode of calculating the cost of Superintendence is the same that was adopted by Major Peat, and is also similar, I believe, to the practice pursued in other branches of the Public Work Department; but as the per centage varies so widely, a word or two of explanation may here be appropriately introduced in order to render the causes intelligible.

Mode of calculating cost of Superintendence.

3. In addition to the consolidated Staff pay and tentage of the Executive Officer, the pay and allowance of the "permanent establishment" are alone admitted into the calculations from which the per centage is derived: the cost of maintaining any "temporary establishment" that may be required, is not taken into account. Now when there is no permanent establishment whatever under the executive Officer, or when it is inadequate for the duties required, there is no alternative but to make up for the deficiency by the temporary employment of the best qualified maistrees and carevons procurable, and the pay of these men is not taken into account in calculating the per centage.

4. In the case of Mr. Armitstead, I do not mean to say, that even were the pay of the temporary establishment he has been thus compelled to employ included in the calculation, it would materially increase the rate for Superintendence, or cause it to exceed $2\frac{1}{2}$ per cent. The rates at which his karkoons and other temporary *employés* are paid have been so low, and the number of labourers so unusually great, that the total charge of the former is the merest trifle when compared with the expenditure incurred in labor and materials on such an extensive line of works; but under different circumstances, and with works scattered over the country and of greater variety, the addition of the pay of the temporary establishment might very perceptibly affect the charge for Superintendence; and this I mention, for the purpose of shewing that rates deduced as at present are not to be considered undeviatingly correct.

Mode of calculating cost of Superintendence.

5. I have mentioned that the whole of the Staff pay of the executive Officer is included in the charge for Superintendence; and although it would be impossible perhaps to do otherwise, still it cannot be doubted that the practice is calculated to convey erroneous impressions. The duties of the executive Officer are as much those of a designer and estimater and accountant, as of an actual superviser of work; and in truth it may be asserted as a general rule, that a far greater proportion of his time is passed in the varied labours of his Office, than in personally watching the progress of the buildings and other public works he may have in hand. To debit the whole of his pay to the charge of "Superintendence," when probably two-thirds of it ought to be allowed to other items, is clearly, therefore, a mistaken principle.

6. In my Report for 1845 | 46, I stated that Captain Jacob had finished a survey of the proposed new terminus to the Mail Road, and was then employed in designing and estimating for the works required thereon. These estimates were duly completed in October, and

Performances of 1st Assistants.

Captain Jacob. New Terminus to Mail Road on Hog Island.

together with the several designs for bridges, drains, causeways, and pier, were submitted to the Military Board on the 12th of that month. As the depth of the creek which separates Hog Island from the reclaimed flats had not been tested however with sufficient accuracy, instructions were received from the Board to probe it to the bottom; and it was at the same time requested, that the slopes over the hilly ground on other parts of the proposed line might be reduced to a maximum of 1 in 20, instead of 1 in 18, as designed by Captain Jacob.

7. The bed of the creek was accordingly probed in various places, and as a rocky stratum was invariably met with within 15 feet of the surface, it was found unnecessary to make any alteration in the estimate for the causeway, which already allowed for a foundation of that average depth, but provision was made for the improved slopes recommended by the Board; and the estimate for the entire line of works, thus corrected, amounted to Rupees two lacks, sixty-five thousand, five hundred and thirty-nine. In this estimate the construction of the road across the flats reclaimed from the sea was incomparably the heaviest item, amounting to no less than forty thousand Rupees a mile, while the rest of the line, inclusive of pier and bridges, barely averaged seventeen thousand.

Rs. 2,65,539.

Rs. 40,000.

Rs. 17,000.

8. A discovery was made in regard to the nature of the flats, however, while the bed of the creek was being examined, which materially interfered with the mode of construction proposed by Captain Jacob; for it was ascertained, on removal of the surface crust or layer, which extended only to the depth of a foot or little more, that the substratum was soft enough to admit of its being penetrated to the very bottom, with almost as much facility as the mud in the creek. Under these circumstances, as wooden piles would not answer, and a loose stone foundation would have been inordinately and almost incalculably expensive, it was proposed to construct the road on the undisturbed surface of the soil, with an under

layer of hurdles to diffuse the pressure and prevent sinking. It was further intended, that this road should have been protected from the encroachments of the sea, by putting the reclaiming lands into a state of efficiency.

9. The mode of construction just described would doubtless have been much less costly than the one Captain Jacob had originally estimated for, under the supposition that he could cut trenches in the soil, and build masonry retaining walls for the support of the roadway; but as it was impossible, in the absence of any data, to calculate the cost with any approximation to accuracy, the estimate was left unaltered.

Reasons for abandonment of the proposed new Terminus.

10. Manifold and undeniable as would have been the advantages of this new line, which would have placed an always accessible terminus some 12 miles nearer Bombay than the present inconvenient and unapproachable one, its probable cost was yet so great, that, until the prospect of a connection between the Presidency and the Deccan at some future day by means of a rail-road, the Government declined sanctioning it: and Mr. Secretary Escombe, in his letter to the Military Board of the 4th June last, No. 1552, stated that certain arrangements with the Bombay Steam Navigation Company, which Government had under consideration, for the conveyance of the Mail to Panwell, would obviate, if carried out, any further necessity for the consideration of the subject of a new terminus.

Kating Tank.

11. On the completion of the duty just described, Captain Jacob undertook the survey of the Kating Tank and its environs, in compliance with a wish expressed by the Hon'ble Court of Directors in their Letter to the Bombay Government of the 21st May 1844, and with a view to determine on the best way of preventing a further accumulation of mud in its bed; but as I shall shortly have occasion to describe how this duty was performed, in another Section of my Report, I will not now dwell upon the subject.

Captain Jacob withdrawn from the Department, and appointed to Superintend the Jamsetjee Bund.

12. It merely remains for me to add, in allusion to Captain Jacob, that as soon as all the designs and estimates connected with the improvement of the Kating Tank had been submitted to higher authority, the interests of Government and the urgency of the occasion rendered it advisable that that Officer should be removed from the Road and Tank Department, to take charge of the Jamsetjee Bund at Poona, which till then had been under the Department of the Superintending Engineer S. P. Independently of losing the services of an Officer whose established reputation would be but little enhanced by any praise from me, and who possesses the rare merit of being just as hardworking as he is talented and able, Captain Jacob's removal, unavoidable as it probably was, afforded further matter of regret to myself, in consequence of its incapacitating the Department from undertaking several projects for the extension of irrigation which it otherwise might have done. The vacancy occasioned by his withdrawal is yet unfilled.

Lieut. Bruce's performances. Wangoolie new line.

13. Lieut. Bruce, at the date of my last Report, was engaged, as therein mentioned, in preparing designs and estimates for a proposed new line of road between Poona and Wangoolie; but these documents, instead of being ready for transmission to the Military Board by the month of October, as I had anticipated, and as they undoubtedly ought to have been, were not received from Lieut. Bruce till the 12th of January following. The estimate for 8½ miles of bridged and finished road, which was minutely worked out and tolerably accurate, amounted after correction to Rupees eighty-eight thousand, nine hundred and eighty-six, and the designs for all the works required on the line were very creditably done. The delay, however, which had occurred in their preparation, was unsatisfactorily accounted for by Lieut. Bruce, and he was consequently remanded to his regiment by Government on the 19th May last, since which date the Department has been without a 1st Assistant,

Rs. 88,986.

Lieut. Bruce remanded to his Regiment.

Jehoor Ghaut.

14. Before leaving the Department, however, Lieut. Bruce had contrived to make a survey of the Jehoor Ghaut on the much traversed road between Nuggur and Aurungabad, which had been represented to be in a dangerous state, and a serious impediment to cart traffic. A sketch survey, remarkably well drawn, and accompanied by a Report, was accordingly despatched to the Military Board's Office on the 25th February last; and had Lieut. Bruce but shown as much alacrity in the previous performance of his duty as he did on this occasion, it is possible that he might have escaped the censure of the Military Board and the displeasure of Government.

Performances of 2nd Assistants.

15. In recounting the performances of the 2nd Assistants, it may be as well to adhere to the practice introduced by Major Peat, and hitherto observed by me, of classing them under distinct headings in connection with the lines of road respectively under their charge; but for the sake of perspicuity, and also with the view of shewing the greater importance that has been attached of late to works for the extension of irrigation and for supplying water to towns and villages, that part of my Report which relates to tanks, bunds, and wells, will appear under a separate head.

I. The Agra Road.

Between Colsette Bunder and Thull Ghaut.

State and expenditure.

16. Lieutenant Scott still remains in charge of that portion of the line which lies between Colsette Bunder and the Thull Ghaut; and the expenditure during the past year has been Rupees nine thousand and seventy. The state of the road appeared to me to have been much improved since my inspection of the previous year; most of it was really good, and considering the inequalities of the ground between Kurdee and Kusara, the immense traffic on the road, and the rough treatment it experiences at the hands of cart-drivers, it might afford matter for surprise how a moorum surface lasts so well.

Unfair treatment of Road.

17. When the opium traffic is at its height, strings of unwieldy and greatly over-loaded carts may be seen descending the steep dips below the ghaut, their wheels locked, and acting like ploughs on the surface of the road; and as if they were not sufficient to destroy it, trunks of trees are frequently attached to the rear of the carts, and with men seated thereon, are trailed after them as drags or make-weights. Such treatment as this is surely sufficient to damage the best of roads: that it should injure a moorum road needs not to be explained.

Proposed new line between Kussara and Kurdee.

18. The survey of Lieut. North's proposed new line of road between Kurdee and Kussara was sent in to the Military Board on the 22nd October last, and the probable cost, roughly estimated by that Officer at Rupees one lack, thirty-three thousand, three hundred and ninety-one, was sanctioned by the Supreme Government, as communicated in Mr. Secretary Escombe's Letter of the 18th March last, No. 712. The new line only deviates from the old one where the dips are at present too steep for traffic, and no slope is to exceed one in nineteen.

Proposed means of carrying it on.

19. The preparation of the several designs for the works required on the new line, as well as the actual commencement of the road itself, have been temporarily postponed till arrangements could be made for rendering an Officer available for the duty. At the date of receiving the intimation of sanction, Lieut. Scott was too much occupied with other work to admit of my recommending him for the performance of this important duty; but on the opening of the season, I am of opinion that he might be advantageously employed thereon, the more especially as the proposed new line is conveniently situated for the purpose, and as the experience which that Officer has now had in the duties of the Road and Tank Department will prove of some service in the performance of this.

Thull Ghaut new Road. Expenditure.

20. The portion of the new road at the bottom of the Thull Ghaut, which in my last Report was stated to have

been commenced in the month of December 1845, was completed by Lieutenant Chapman on the 27th of December last, when, in conjunction with the portion previously finished, it was opened to the public, and has since been in constant use. The expenditure on the entire completed piece of road, which is in length a mile and a half, amounted to Rupees seventy thousand, two hundred, and fifty-six. Rs. 70,256.

21. The portion of road which was first completed was formed with an inward slope, the outer edge having been made a foot higher than the inner, and the surface a plane instead of a curve. The road at the bottom of the ghaut has been constructed with the usual slight convexity of surface, and will not only therefore be much easier for draft, but will also, I think, be more evenly used throughout its entire breadth than the other, and will consequently suffer less from the heavy traffic that passes over it.

22. On the completion of the lower portion, the encampment of labourers, with store-house and work-shop, were removed with all expedition to the top of the ghaut, the cuttings on which were commenced in the month of January, and carried on with as much celerity as the paucity of labourers in that neighbourhood would admit of. Up to the 30th April last, 4,200 running feet of side cutting had been completed to the full width of roadway, and 1157 feet completed to average widths of 10, 12, and 18 feet respectively.

23. The estimates for the completion of the road over the ghaut were despatched from this Office, after examination and amendment, in the month of September last, the total amount being Rupees one lack, forty-eight thousand, three hundred and ninety-one, which was sanctioned by Government on the 12th of the following month. The parapet wall which has been built along the edge of certain portions of the roadway already completed, and which was described in the 18th para. of my Report for

Ghaut estimate and plans.

Rs. 148,391.

1845 | 46, having been considered unnecessarily expensive by the Military Board, a more simple style of construction has been provided for in the estimate, viz. dry rubble.

Road between Thull Ghaut and Nassick, and between Nassick and Chandore. State and expenditure.

24 The road from the top of the Thull Ghaut to Nassick is in much the same state as it was last year, slightly improved in some places, a little fallen off in others; but from Nassick to Chandore, a very decided change for the better was observable at the date of my last visit, and it would have been difficult to find a half mile in any portion of its length that could have been justly characterized as in bad, or even in indifferent, order. Considering the state that I found it in on my first inspection, this improvement is very creditable to the Officer in charge. The expenditure on the whole during the past year, from the top of the Thull Ghaut to the bottom of the Chandore Ghaut, has amounted to Rupees twelve thousand nine hundred and thirty-six.

Rs. 12,936.

Flying Bridge at Kokungaom.

25. The ferry boat on the Radwa river at Kokungaom has been converted into a flying bridge by the addition of standards and ropes: ramps have also been cut through the banks for landing places, and approaches from the main road have been constructed, the whole at a cost of Rupees five hundred and sixty-five.

Rs. 565.

Proposed Bridge at Pimpulgaom. Lieut. Cowper, of the Engineers, appointed to the Department and engaged in estimating for other improvements required on the line.

26. A Bridge of 60 feet span has been designed by Lieutenant Chapman for the Pharasherry river at Pimpulgaom, where the Post is occasionally delayed as much as 8 hours, and an estimate has been laid before the Military Board; but as some modification in the centering appeared desirable, with a view to diminish the cost, a month or two will probably elapse before the proposed work can receive the sanction of Government. The small rivers at Wozur and Argaum require also to be bridged as recommended in my Report of last year, and the requisite plans and estimates are under preparation by Lieutenant Cowper of the Engineers, who has been attached to this Department for the purpose of estimating for these and

other improvements between Egutpoora and Chandore, which the Post Master General has in a late report to Government represented to be advisable.

II. Mail Road.

27. Captain Pruen and Lieutenant Cowper still retain charge of the portions below and above the ghaut respectively; the expenditure for repairs under the former having amounted to Rupees five thousand nine hundred and seventy-three, and under the latter to Rupees fifteen thousand five hundred and forty. The three years' contract with Venkuttish Narrain for the repair of the mail road under Lieutenant Cowper having terminated on the 30th April last, fresh tenders were invited for the performance of the repairs for the ensuing season, and the lowest tender having come from Nunderam Soonderjee, a man of character and substance, has been approved of and accepted.

Below the Bhore Ghaut. Rs. 5,973.
Above do. Expenditure. Rs. 15,540.

28. The raising of the Panwell Bunder, as well as the construction of masonry rivetments to protect it from the tide, have been carried on during the past season, and are now completed at a contract cost of Rupees five thousand seven hundred and twenty-five; but I regret to say, that the contractor, Govind bin Hurry, has given a deal of trouble, by frequent attempts to introduce bad work, and that it has been necessary to resort to the most stringent remedies the terms of the agreement allowed of in order to prevent his succeeding in these fraudulent practices.

Panwell Bunder. Rs. 5,725.

29. The sum required for bridging and metalling the New Akoordie line, amounting in the aggregate to Rupees twenty-eight thousand four hundred and twenty-six, was sanctioned by the Court of Directors under date the 25th November last, and the works are now in progress by contract under the orders of Lieutenant Cowper. The entire cost of this piece of road, which is 8½ miles in length, will on completion have amounted to Rupees

Completion of new Akoordie line sanctioned by the Hon'ble Court. Rs. 28,426.

Rs. 46,858. Rs. 5,512.

forty-six thousand eight hundred and fifty-eight, or five thousand five hundred and twelve Rupees per mile, which may be accounted a rather moderate rate than otherwise for a metalled and perfect road in the Deccan, considering that the country is almost always either undulating. and intersected by numerous watercourses, or else composed of black soil where the foundations of a road are an unavoidably expensive item.

Probable date of completion and saving in annual expenditure for repairs.

30. The contractor is not bound to finish the work before the 31st July 1848, but it is an object of importance to have the new line open by the commencement of the monsoon, every exertion is being made, and will continue to be made, to prevent any work remaining on hand after the beginning of June. As the Ounde and Panowlie and Bhojapoor lines will be abandoned on the completion of the Akoordie road, the saving in road repairs will amount to no less than Rupees four thousand eight hundred per annum.

Rs. 4800.

Junction line with Seeroor road by Holkar bridge.

Rs. 7827.

Rs. 6350.

31. A short line of junction between the Dapoorie and the Holkar Bridge was at the same time sanctioned by the Hon'ble Court at an estimated cost of Rupees seven thousand eight hundred and twenty-seven; but as it appeared likely that a contractor might be found to do the work for a smaller amount, tenders were invited, and the lowest, amounting to Rupees six thousand three hundred and fifty, has been accepted. This short piece of road is intended to perfect the communication between Bombay and Nuggur, when the Bhojapoor line shall have been abandoned; but it is believed, that during the fair season the greater portion of the traffic between those places will proceed by Poona and Kurradee.

Culverts and drains required between Poona and Khundalla.

32. The plans and estimates which were alluded to in my last Report as being under preparation by Lieutenant Cowper for a number of small bridges and drains required on the Mail road between the Western extremity of the Akoordie new road and Khundalla, were despatched to the Military Board Office on the

31st of May last, the aggregate of the estimate amounting to Rupees thirty-one thousand two hundred and twenty-four, and the number of works provided for being fifty-three. A few of the streams for which culverts or drains of several water-ways have been designed, are from four to two feet deep in the monsoon, and form an occasional obstruction to the Post, but the generality are small, and are chiefly to be objected to as being injurious to the road.

Rs. 31224.

33. Plans and estimates prepared by the same Officer have also been sent in for widening that part of the Mail road which lies between Dapoorie Bridge and the point of junction with the Seeroor road, and the maximum width of which is at present only 17 feet. These estimates were originally called for by Major Peat, who foresaw the necessity that would exist for making this portion of road of a convenient width as soon as the completion of the Akoordie road should have thrown it open to all the traffic between Bombay and Poona. The length to be widened is 2 miles and 581 yards, and the estimated cost of making it uniformly 25 feet broad, inclusive of the cost of drains, amounts to Rupees ten thousand five hundred and sixty-seven.

Widening the road through Kirkee.

III. Road between Poona and Nuggur.

34. Mr. Scott is still in charge of this line of road, and the expenditure on repairs during the past year has amounted to Rupees eight thousand two hundred and twenty-three. On the whole it may be said to have been generally improved by the trouble that was bestowed on it last monsoon; and in some places, especially near Soopa, where the moorum is of first-rate quality, it is equal in smoothness of surface and almost in hardness to the best parts of the Mail road.

State of the road and expenditure.

Rs. 8223.

35. The two bridges of stone and chunam masonry which in my last Report were stated to have been sanctioned by Government for the nullahs at Kondapoor

Two new stone bridges.

Failure of mud centering.

and Wusudwadee, the one at a contract cost of Rupees six
Rs. 6995. thousand nine hundred and ninety-five, and the other at a
Rs. 4305. contract cost of Rupees four thousand three hundred and five, were commenced in the month of October last under the orders of Mr. Scott. The progress of both works was very satisfactory up to the month of May last, when an unseasonable and totally unexpected fall of rain caused a sudden rise in the nullah at Kondapoor, which produced a slight sinking in the mud centerings, and thus caused the arches of the bridge then being turned to shew cracks between their haunches and the skewbacks of the pier. No alternative presented itself but to pull down the damaged arches and the incorrect centerings, and as the monsoon was at hand to postpone further operations till the re-opening of the fair season. Of course the contractor was in no wise to blame, as the accident was one over which he had no control, and which could not have been foreseen. The nullah at Wusudwadee, though distant only 3 miles from Kondapoor, was neither flooded nor in any way affected by the fall of rain alluded to, and the progress of the bridge advanced therefore without interruption.

Shikarpoor bridge. 36. The retaining walls of the Eastern approach of the Shikarpoor Bridge, which are constructed of dry stone squared and coursed, and which, adjoining the abutments, are no less than 25 feet in height, began to bulge and give way in the latter end of 1845. A portion which had actually tumbled down was re-built by Mr. Scott in the
Rs. 309. month of July of last year, at an outlay of Rupees three hundred and nine, but a much larger expenditure will be requisite before the security of the entire approach can be ensured. The bridge was built in the year 1842 | 43, under the orders of Lieutenant Hart of the Engineers, and the fault of construction in the retaining walls appears to lie in want of bearing in the facing stones, and in the looseness of the backing.

Seena river. Best way of bridging it. 37. Having very attentively examined the bed of the Seena river when last at Nuggur, it appeared to me that

if piles could be forced to penetrate the hard stratum below the gravel of which the bed consists to the depth of a couple of feet or so, the style of bridge best suited to the locality, and incomparably the cheapest, would be a wooden one, and the Military Board have sanctioned an experiment being made to ascertain this point. Though styled a river, and in point of breadth almost deserving of the name, being 333 feet across, the extreme height of its banks does not exceed 4 feet, and as the layer of gravel which forms its bed is 12 or 13 feet in depth, a masonry bridge, with foundations springing from the rocky stratum, would be enormously expensive, considering the ordinary shallowness and insignificance of the stream. Were the river freshes confined indeed within its proper channel, it might be almost doubted whether a bridge of any sort would be absolutely required, but flooded as the banks occasionally are to a considerable distance, the stream is at times impassable.

Wire ropes for flying bridges. Their efficiency.

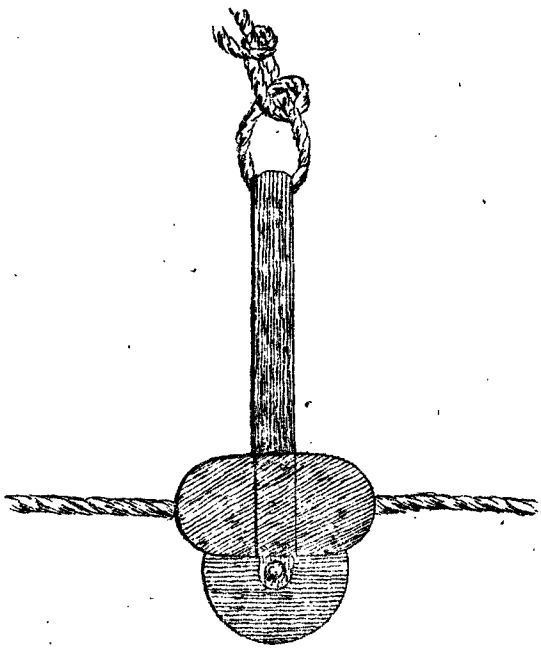
38. The wire ropes which were substituted last monsoon in lieu of the usual hempen hausers for the flying bridges at Koregaon and Poona, are likely to prove far more economical than the latter; and with the improved species of traverser which has been introduced instead of the ordinary swinging block, the passage of each raft across the river is reported by the boatmen in charge of the flying bridges to be effected with much greater celerity than formerly. The only fault or failing in the wire rope that has yet been discovered, is its liability to oxidation, but this may possibly be remedied by an annual coating of tar.

Substitute for swinging block.

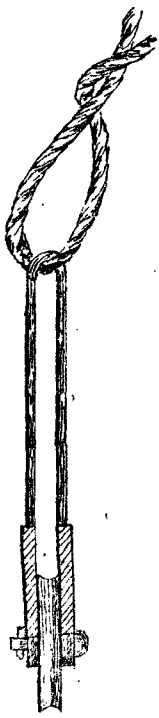
39. The new traverser just alluded to, the efficiency of which was stated in my last year's Report to be then under trial, has these advantages over the old block: 1st—that it is but very slightly worn away during a season by the friction of the rope, instead of being rendered useless as the block was in the course of a month; 2dly—that it can never be top-heavy as the blocks frequently were, and

that it therefore traverses more freely; 3dly—that it is shipped and unshipped simply by the removal and replacing of the pin of the sheave, while the fixing or unfixing of a block necessitated the unfastening and refastening of the rope itself; and 4thly—that it costs seven Rupees less in the construction. As it is not likely, however, that the mere detailing of its advantages will convey a correct idea of this simple contrivance, a sketch is subjoined, which will obviate any necessity for further description. The sheaves or rollers, it may be observed, are case hardened exteriorly, and the loops or shanks are of wrought iron.

Rupees 7.



Side view



Front view

40. The new line between Poona and Wangoolie *viâ* Kurradee, I have already alluded to in mentioning Lieut. Bruce's performances, but as it is not improbable that at some future day this may be the only established line of communication towards Nuggur, I may here take the opportunity of stating, that the construction of a bridge across the Moota Moola at Kurradee having been deemed by yourself of greater primary importance than the completion of a road without the bridge, the Military Board have directed the subject to be taken into consideration.

Proposed new line between Poona and Wangoolie.

41. The flying bridge which plied opposite the town, and which became useless on the completion of the Poona bridge, has been removed to Kurradee, where it is now being established at a contract cost of Rupees one thousand nine hundred and thirty-one. The chief causes of this work being so expensive are, 1st—the extensive repairs required by the two boats and other woodwork of the raft, and 2ndly—the great amount of rock-cutting which was found to be requisite at the new site in the formation of Ramps.

Removal of Poona flying bridge to Kurradee.

Rs. 1,931.

IV. Road between Poona and Neera Bridge.

42. This road is still under charge of Mr. Scott, and has been repaired during the past season at a cost of Rupees two thousand six hundred and forty-six, which has been laid out with great advantage and considerably improved its condition. The Bapdeo Ghaut will always be a formidable obstacle to traffic, which is not however so important on this line as to render the construction of a new ghaut advisable.

State and expenditure.

Rs. 2,646.

Bapdeo Ghaut.

43. On the requisition of the Post Master of the Deccan, an estimate has been prepared and submitted, amounting to Rupees five hundred and thirty-nine, for the erection of huts at five stages between Poona and Jeejoorie, for the use of the dawk runners on this line.

Huts for dawk runners.

Rupees 539.

V. Road between Nagotna and Mahableshwur.

State and expenditure.

Rupees 5025.

44. This road has been repaired by contract under Captain Pruen, at an expense of Rupees five thousand and twenty-five, and is in fair order, and but little damaged by Mr. Baretto's Phaetons having been re-established between Mhar and Nagotna.

Ceiling to bungalow at Indapoor.

Removal of rocks in Nagotna river.

Rupees 101.

Rupees 36.

45. The only works which have been performed on this line during the past season are of a trifling nature, one being a numda ceiling to the travellers' bungalow at Indapoor, at a cost of Rupees one hundred and one; and the other, the removal by blasting of certain rocks which impeded the navigation of the Nagotna river, at a cost of Rupees thirty-six.

VI. Cross Roads in the Poona Collectorate.

Expenditure.

Portion of road now used as Mail Road will revert to its former use of cross road.

Rupees 4,348.

Rupees 303½.

Rupees 98.

46. The roads which are classed under this head, and which are in length 54¾ miles, have been repaired during the past season at an aggregate cost of Rupees four thousand three hundred and forty-eight. The portion of road which connects the Dapoorie bridge with the Bhojapoor road, which is 2 *m.* 5 *f.* 180 *yds.* in length, and which has heretofore been repaired as part of the Mail road at a cost per mile of Rupees three hundred and three and a half, will revert to its former use as part of the Narriangaum road on the completion of the Akoordie new line, and will be repaired like the rest of that road with moorum instead of metal, at an annual expense of ninety-eight Rupees per mile.

VII. Cross Roads in the Nuggur Collectorate.

Rupees 737.

47. The repairs to these roads, which still remain under charge of Mr. Scott, have been made during the past season at a cost of Rupees seven hundred and thirty-seven, and their state remains the same as at the date of my last Report.

VIII. Cross Roads in the Nassick Sub-Collectorate.

48. The outlay on these roads for the past season amounts to Rupees one thousand six hundred and thirty-nine, and they are in tolerable order.

State and expenditure.

Rupees 1,639.

49. A bridge over a large nullah on the road between Nassick and Sinnur, and about a mile distant from the former place, was partially swept away by a heavy flood in the month of June of last year, and was repaired at a cost of Rupees two hundred and ninety-seven, and the Nassurdy Causeway was also slightly injured on the same occasion. No damage would in my opinion have been sustained by either of those works, had their style of construction been as good as it ought to have been.

Injury to a bridge from last monsoon flood.

Rupees 297.

IX. Cross Roads in the Tannah Collectorate.

50. The aggregate expenditure on these roads for the past season amounts to Rupees three thousand five hundred and twenty-two. The Collector of Continental Customs and Excise, under date the 29th August last, suggested the advisability of widening and raising certain portions of the road between Khopoolie and Dhurm Tur, and a Report has been received from Captain Pruen on the subject, which is now under consideration.

Expenditure. Proposed improvement.

Rupees 3,522.

51. The Collector of Customs at the same time recommended the construction of branch roads to the Salt works at Wansee and Oomarda, which are situated, the former at three miles, and the latter at one mile, from the main road; but it appeared to Captain Pruen, after an examination of the country, that the work would be more expensive than the occasion called for, and that it would be sufficient to bridge two salt-water creeks, which, after the middle of the month of November, are the only impediments that exist to traffic. Plans and estimates for these works are consequently in course of preparation.

Two salt-water creeks proposed to be bridged near Penn.

X. Cross Roads in the Rutnagherry Collectorate.

State and expenditure.

Rupees 1,169.

52. The roads in the above Collectorate have been repaired during the past season at a cost of Rupees one thousand one hundred and sixty-nine, and are represented to be in good order.

XI. Roads in Salsette.

State and expenditure.

Rupees 11,731.

53. These roads are still under Lieutenant Mungavin, and have been repaired during the past season at a cost of Rupees eleven thousand seven hundred and thirty-one. Though a trifle better than they were, they have not been improved to the extent that I anticipated at the date of my last Report; and I was informed by Lieutenant Mungavin, that during last rains the iron rollers, which have been found so effective elsewhere, had but little effect on the Salsette roads. The only way in which I can account for this is under the supposition, that the roads have been so deteriorated for some years past by the admixture of bad moorum and earth with the metal, that it is now impossible to get a thin layer of the latter material to form a compact surface.

New line of road in Salsette under construction by subsidiary Jail.

54. The new line of road between Coorla and the twentieth mile-stone *viâ* Bhandoop, which was stated in my last Report to have been sanctioned by the Government of India, and about to be undertaken by a Subsidiary Jail, was not commenced till the 16th of December last, in consequence of the delay that occurred in supplying guards, by which means six weeks of the working season were irretrievably lost. When once commenced, however, the work proceeded with rapidity, and up to the end of April last, a length of nearly four miles had been completed, inclusive of bridges and cross-drains, with the exception of the parapets.

Do. Representation by Framjee Cowasjee, Esq. regarding his estate of Poway.

55. In the month of February last, when some progress had been already made, a representation which had been addressed to Government by Framjee Cowasjee,

Esquire, was received in this Office, to the effect that the value of his estate of Poway would be very much deteriorated by the abandonment of the old and the construction of the new road, the former having passed through the estate, while the latter would merely skirt it; and it was further attempted to be shewn, that a shorter and a better line than the Bhandoop one might be carried through another part of Poway, with mutual advantage to the public and the proprietor.

Superiority of Captain Crawford's Bhandoop line, over Framjee Cowasjee's Poway line.

56. In consequence of this representation, instructions were received by the Military Board from Government, to cause Framjee Cowasjee's new line to be surveyed and levelled; but as this duty had already been performed by Captain Ash when engaged on the Vehar Khind survey, whose field books were in my Office, nothing was easier than to plot the survey, and lay down the longitudinal section on paper with accuracy. This was accordingly done, and in company with a detailed Report, which a careful inspection of the ground had enabled me to prepare, the survey and section were submitted to the Military Board in the month of March, the whole plainly proving, that Captain Crawford's Bhandoop line was, in all the essential characteristics of a good road, superior to the Poway one. It was better watered, better wooded, shorter, and more level, and the Govenment in consequence decided, that it should be carried out as originally contemplated; but with the view of preventing any injury to Framjee Cowasjee's estate, instructions were subsequently issued by Government, that on the completion of the new line a branch road should be constructed connecting it with Poway, and the necessary sketch is now under preparation by Lieutenant Mungavin.

Cause of extra expense on account of present Subsidiary Jail.

57. It was originally intended, and instructions were given to that effect by the Military Board, that the accounts connected with the cost of the Subsidiary Jail should be so carefully kept, that the relative expense of convict and free labour in the construction of roads in

this Country should be satisfactorily determined. This object, I need hardly say, has been most carefully kept in view; but I am inclined to believe, that the result of the experiment will be less favourable to the employment of convicts than it would have been had no delays been permitted to occur; and this much I think is clear, that a Subsidiary Jail would be employed to much greater comparative advantage on a line of work that could be completed in one season, than on an undertaking of greater magnitude, where more than one season would be required; for the contingent expenses incurred on account of guards and establishment during the monsoon, when there is no equivalent in the shape of work, must make a material addition to the debit side of the Jail account.

Bridge under construction at Erla Parla.

Failure of mud centerings.

58. The proposed new bridge at Erla Parla, which was stated in my last Report to have been then estimated for, was commenced by contract under the orders of Lieutenant Mungavin in the month of February last, and progressed fairly and satisfactorily till the beginning of June, when the self-same cause which proved so injurious to the centerings and arches of the bridge at Kondapoor on the Seroor road, had a similar effect on the work at Erla Parla. A heavy and unlooked for fall of rain caused one of the centerings to sink, and the arch to crack, so that I have been obliged to direct Lieutenant Mungavin to see that the contractor re-constructs it on a correct centering.

Advantage and defects of mud centerings.

59. In both cases the centerings were of mud and rubble, a style of construction which is in so far preferable to wood, that it is much cheaper, and more expeditiously carried on; but, as will have been seen by the instances now brought to notice, it is not to be relied on in wet weather, and becomes decidedly dangerous as the rains approach. Mud centerings ought never, therefore, to be used, except in cases where there is a certain prospect of the arches being completed, and the mortar set, before the usual period of the first monsoon showers.

XII. Poona and Sholapoor Roads.

Portion leading out of Poona.

60. The piece of metalled road leading out of the town of Poona in the direction of Sholapoor, is 2*m.* 3*f.* 200*y.* in length, and has been repaired by Mr. Scott during the past season at a cost of Rupees six hundred and thirty-one. That part of it which is beyond the camp having been but recently completed, needed but very little re-metalling, and thus the average cost per mile appears somewhat small, but during the current year it will more nearly approximate to the usual charge for other metalled roads under this Department.

Rupees 631.

New road under construction between Patus and Indapoor.

61. That portion of the Poona and Sholapoor Road which is now under construction between Patus and Indapoor—a distance of 44 miles and 6 furlongs—has been expeditiously carried on, since the date of my last Report, by Mr. Sub-Conductor Armitstead. On the 30th April of last year, 9 miles and six furlongs had been trenched and raised with moorum; on the 30th April of the present year, 43 miles and 5 furlongs had been trenched and raised, 13 miles cross-drained, 17 miles curbed, and 7 miles completely finished. On the portion cross-drained, 1 small bridge, 3 culverts, and 66 drains of sorts, had been constructed. The entire expenditure had amounted to Rupees one lack, forty-two thousand, two hundred and eighty-four, out of which sum Rupees one lack, twenty-three thousand two hundred and eight, had gone solely on labour and its trifling proportion of superintendence.

Progress and expenditure.

Rs. 1,42,284.

Rs. 1,23,208.

Estimated cost of completion.

62. An estimate for the completion of the road and all the works required thereon, accompanied by appropriate and well executed designs, was received from Mr. Armitstead in February last, and forwarded to the Military Board on the 16th of that month. It provided for all work that remained to be performed on the first day of the present year, and amounted to Rupees one lack, thirty-one thousand six hundred and forty-three; so that as the expenditure up to the close of last year had

Rs. 1,31,643.

Rs. 1,22,985.

amounted to Rupees one lack, twenty-two thousand, nine hundred and eighty-five, the total probable cost for the entire piece of road between Patus and Indapoor will be Rupees two lacks, fifty-four thousand, six hundred and eighty-eight, or Rupees five thousand, six hundred and ninety per mile.

Rs. 2,54,628.

Rupees 5,690.

Style of work described.

63. After visiting Indapoor in November last, and carefully examining the works in progress, I was enabled to submit a very satisfactory account of Mr. Armitstead's proceedings to the Military Board; such deviations as had been made from the old track appeared to me judicious, and the work of every description was excellent. The masonry of the culverts and drains is composed of hammer dressed, or rough cut, stone and chunam, and the workmanship is inferior to none that I have seen in this Presidency. The curb stones are of an almost uniform size, and of the best basalt, varying not more than from $10'' \times 10'' \times 18''$ to $9'' \times 9'' \times 15''$; and should any objection be made, either to these or to the masonry, on the score of their being too good or too expensive, I have only to mention, that good as they are, the curb stones only cost three and a quarter Rupees per 100 running feet; and that excellent as the masonry is, a culvert of 3 arches, each of 5 feet span, is completed for the moderate sum of Rupees six hundred and forty-seven.

Rupees $3\frac{1}{4}$.

Rupees 647.

Mode of proceeding in constructing the road, with cause.

64. This road, as I mentioned in my last Report, was undertaken for the sake of affording employment to a distressed population; and as those who sought relief were either cultivators out of employ, or the Mhars of the surrounding villages, unmixed with builders or other artificers, it was of course necessary, with the view of turning their physical strength to the best account, to set them to work on what required the least teaching, *i. e.* the trenching and raising of the roadway.

Proposed mode of proceeding in future in opening a new line of communication.

65. Thus it is, that the entire raising of 44 miles was almost completed before a single bridge or drain had been commenced; but under other circumstances, where

choice should be the guide and not necessity, the system which you have before now advocated is the one that would be followed; and the passage of such rivers and streams as were calculated to impede traffic, would be the first step to be accomplished in opening a new line of communication. The Military Board, indeed, guided by the same views, have already instructed me to send in rough estimates of the cost of bridging the remainder of the Sholapoor Road.

XIII. Nagpoor Dawk Line.

Expenditure.

66. Captain Dennis still retains charge of the line of works between Nuggur and the Wurda River, and the expenditure during the past season in repairing and renewing old works amounts to Rupees ten thousand three hundred and six.

Rupees 10,306.

Fewer delays than formerly.

67. Delays on this line appear now to be of rare occurrence, instead of great frequency, as was the case some few years back; and it may be safely inferred, therefore, that rude and unstable as many of the bridges and other constructions are, they are yet moderately efficient so long as they last.

Sample of rope suspension bridge completed in last monsoon.

68. A sample of the rope suspension bridge, which it was proposed at the date of my last Report to substitute for flying bridges over the large nullahs on this line, was completed in the month of July of last year by Captain Dennis, who reported favourably of its utility and suitableness for the dawk runners or foot passengers; but he at the same time gave it as his opinion, that great difficulty would be experienced in crossing the horses, who would naturally take alarm at the oscillating motion of the foot way. This opinion was undoubtedly well founded, for the bridges were only designed with the view to afford a safe and speedy passage to the men themselves, for which the flying bridges had been so ill-adapted.

Possibility of adapting then to the passage of horses.

69. As it did not appear impossible, however, to make such improvements in the construction and sub-

stantiality of bridges of this description as would admit of horses crossing over without difficulty or fear, an experiment is about to be tried with wire-ropes and a firm flooring, protected on either side by a light railing.

Proposed flying bridge at Toka.

70. The ferry across the Godavery at Toka has been transferred to the charge of Captain Dennis from that of Mr. Scott, as proposed in my Report of last year, and, on the recommendation of the former Officer, is about to be converted into a flying bridge, for which the raft which was constructed by this Department last season will answer the purpose very well. As no flying bridge exists on this side of India of so great a span as this will be, the standards will require to be of unusual height and strength, and the rope it is intended shall be of wire $3\frac{1}{2}''$ in circumference, which is equal in strength to an $8\frac{1}{4}''$ hempen hawser.

XIV. Works off the regular lines of Road.

New bridge at Poona.

71. The Poona bridge, which was commenced on a design of Major Peat's in the month of November 1844, was completed by contract under Lieutenant Cowper's orders in December last, at a total cost of Rupees twenty-eight thousand two hundred and twelve, out of which the inhabitants of the Town bore Rupees ten thousand three hundred and eighty-two. To this outlay has subsequently been added the sum of Rupees one thousand three hundred and fifty-two, being the calculated amount of expense the contractor was put to in pulling down and removing the centerings, and the consequent amount of compensation adjudged by Government. The entire cost of the bridge, therefore, from first to last, has amounted to Rupees twenty-nine thousand five hundred and sixty-four, and no one can deny that it is extremely moderate.

Rs. 28,212.

Rs. 10,382.

Rs. 1,352.

Rs. 29,564.

Gokhirwa bridge, excess upon the estimate.

72. The partial re-construction and improvement of the Gokhirwa Bridge near Bassein, which was stated in my last Report to have been then estimated for and

sanctioned by Government at a cost of Rupees five thousand seven hundred and two, has also been carried on during the past season, and must ere this have been completed: but numerous circumstances have combined to render an excess upon the estimate unavoidable. In addition to the fact of building materials having turned out to be much dearer in that neighbourhood than was originally calculated on, it was found, on dismantling the bridge, that the timbers were in such a state as to preclude the possibility of their being used to a tenth of the extent that was allowed for; and as a still further cause of increased expenditure, the progress of the work was much retarded by the tides, by which at the springs the piers and abutments were covered for several days. A supplementary estimate, therefore, became unavoidable, and Government have accordingly sanctioned an additional sum of Rupees nine hundred and seventy-six.

Rs. 5,702.

Rs. 976.

73. Lieutenant Scott has also constructed a flight of steps to the Jetty at Callian, and repaired the Mamlutdar's Cutcherry at the same place, the former at a cost of Rupees forty-three, and the latter at a cost of Rupees two hundred and twenty-eight; and the same Officer has likewise finished the extensive repairs which were required to the Kusseylee Bunder, and which, as stated in my last Report, has been postponed on account of the rains, the total expense having amounted to Rupees one thousand seven hundred and eighty-two.

Works at Callian and Kusseylee Bunder.

Rupees 43.

Rupees 1,782.

74. Lieutenant Mungavin completed the boat intended for the ferry at Oomergaom, at a cost of Rupees five hundred and seventy-one, and despatched it to that place in the month of January last.

Oomergaom ferry Boat.

Rupees 571.

75. An estimate for a Mamlutdar's Cutcherry at Oorun in Carrinja was sanctioned by Government under date the 30th April last, for Rupees one thousand three hundred and sixty-seven, and will be commenced by contract under the orders of Captain Pruen, on the opening of the season.

Cutcherry at Oorun.

Rupees 1,367.

Cutcherry and Bungalow at Kelwa Mahim and Bassein.

76. Estimates, accompanied by plans, were submitted to the Military Board in the months of October and February last, for an Assistant Collector's Cutcherry at Kelwa Mahim, and for a Bungalow for one of the Uncovenanted Assistants of the Collector of Continental Customs and Excise at Bassein, the former amounting to Rupees four thousand nine hundred and fourteen, and the latter to Rupees five thousand four hundred; but nothing has been communicated in regard to their sanction.

Rupees 4,914.

Rupees 5,400.

XV. Military Buildings.

Regimental buildings at Tannah.

77. The repairs to the Military Buildings at Tannah have been completed by Lieutenant Mungavin for Rupees one hundred and seventeen, and the same Officer has constructed four new pendalls, and improved two old ones, for the sum of Rupees three thousand four hundred and seventy, a saving of Rupees two hundred and twelve having been effected on the estimate for the repairs, and a saving of Rupees seven hundred and seventy-nine on the estimate for the new pendalls, the former in consequence of the reduction of work caused by the removal of the temporary pendalls, and the latter in consequence of the employment of convict labour.

Rupees 117.

Rupees 3,470.

Rupees 212.

Rupees 779.

New Hospital at Tannah.

78. Lieutenant Mungavin is also now engaged in building a Detachment Hospital at Tannah, 56¾ feet in length by 18½ feet in breadth, with dispense rooms and out-offices, the estimates for which, amounting to Rupees four thousand three hundred and forty, were sanctioned by Government under date the 12th March last.

Rs. 4,340.

Two additional pendalls for Ghaut Light Infantry.

79. An estimate prepared by Lieutenant Mungavin, amounting to Rupees two thousand one hundred and thirty-eight, and accompanied by a plan, was submitted to the Military Board in the month of May last, for two new pendalls for the use of the Detachment of Ghaut Light Infantry stationed at Tannah, but no intimation of sanction has yet been received in this Office.

Rs. 2,138.

80. The Regimental Buildings, which were stated to be in progress at Nassick at the date of my last Report, were completed under the orders of Lieutenant Chapman in the month of September last. The estimated and sanctioned amount was Rupees three thousand three hundred and sixty-six, but through the extreme carelessness and negligence of Sub-Conductor Viges, to whom the superintendence of the work had been entrusted by Lieutenant Chapman while himself otherwise engaged, this sum was exceeded by a very large amount. From Lieutenant Chapman's explanation of the business, it appeared that the estimate itself was deficient to the extent of Rupees four hundred and twenty-one, but independently of all the legitimate causes which could be assigned for an excess upon the sanctioned amount, Lieutenant Chapman discovered, on investigating the case, that there was an additional sum of Rupees one thousand one hundred and fifty expended, for which Mr. Viges was totally unable to account.

Buildings at Nassick.
Heavy excess.
Sub-Conductor Viges's misconduct.
Rs. 3,366.
Rs. 421.
Rs. 1,150.

81. That the Sub-Conductor did not appropriate the whole of this money to his own use was very clear, as certain sums were traceable into the possession of some of the Native subordinates, who absconded; that he took even a portion of it has not been proved, and may be doubted; but that the loss was entirely owing to the most gross negligence, enhanced by indulging in habits of intemperance, was unfortunately but too evident.

82. This, however, was not Mr. Viges's only breach of duty. He abstracted from the bag entrusted to his charge for the payment of the people employed on road repairs, the sum of Rupees two hundred and thirty, with which he liquidated a private debt. The fault was freely acknowledged, and it is possible Mr. Viges might have intended to re-place the money as soon as he was able; but it was perfectly clear, that a man who could be guilty of such neglect of duty and dishonesty was unfit for any situation of trust under Government; he was there-

Rs. 230.

fore removed from this Department, and remanded to his Corps as a 2nd Corporal.

Addition to buildings at Nassick.

Rs. 591.

83. Some additions to the buildings alluded to were sanctioned by Government in the month of January last, at a probable cost of Rupees five hundred and ninety-nine, and are now progressing towards completion.

XVI. Tanks, Bunds, and Wells.

Extension of irrigation.

84. Though the energies of the Road and Tank Department have been directed to the accomplishment of more important undertakings than had ever previously engaged the attention of any branch of the Public Work Department under this Presidency, still it has furnished cause for complaints, and has been a source of regret to myself, that comparatively speaking, but little has been effected towards the extension of irrigation throughout the country by means of Tanks, Bunds, and Wells.

Conflicting interests.

85. To remedy this deficiency, the most strenuous efforts have been latterly made, but owing to the numerous difficulties which have been encountered, and the many conflicting interests which often have to be reconciled before a work can be undertaken, less progress has been made than could have been wished, though, on perusal of the following Report, I think it must be admitted that, as far as the Road and Tank Department is concerned, matters are in fair train towards effectual and speedy amendment.

Bunds constructed by former Governments many of them easily repaired.

86. Before entering into particulars, however, I would request permission to say a word or two on the subject generally; and first, in regard to the policy and advantage of putting into an efficient state such of the old works which are to be found scattered throughout the country, as may now only need a few repairs to render them as productive to the revenue of the existing Government as they were to those of former times. Of these works, the most deserving of attention are the bunds and bundarras by means of which the land on either

bank of many rivers and rivulets was fertilized and rendered productive throughout the greater part of the year. To say what amount of profit would be yielded by the repair of each, would of course require the knowledge and experience of a Government Revenue Officer; but as far as rendering them efficient may be concerned; numerous are the instances in which a trifling expenditure, and a very small amount of engineering skill, would suffice to secure the desired result; and surely, unless my judgment is greatly at fault, it would be but a common act of prudence to incur a small outlay in perfecting those ancient works, whose strength and substantiality have resisted the floods of possibly a century, and whose utility has been proved beyond a doubt, before we make attempts at constructing most costly and expensive new ones—attempts, moreover, which like others of recent date might chance to prove abortive, despite the amount of science and talent which would doubtless be brought into requisition.

Bunds in the Nassick Collectorate requiring repair.

87. With views such as these, it was my anxious wish to have had some fifty bunds in the Nassick Collectorate put into a state of efficiency; and as the Collector and the Superintendent of the Revenue Survey were both agreed as to the advisability of the measure, I proposed to the Military Board, under date the 11th August 1846, that a First Assistant of the Department should be employed in reporting on and estimating for the whole. This duty would have been in consequence performed by Captain Jacob long ere this, but for his untimely removal from the Department, to superintend the re-construction of the damaged portion of the Jamsetjee Bund at Poona; and as no other Officer's services have been available for the work, it still remains in abeyance.

Two essentials in the site of a bund.

88. Another remark which ought to precede my Report on the subject of works for irrigation is, that easy as it may appear at first sight to discover places where bunds might be constructed with effect, there are

two points to be considered and made to agree before any thing definite can be attempted; for not only ought the locality selected to be free from all engineering difficulties, and to afford every facility for the construction of the proposed work, but it ought also to be so peculiarly situated as to render remuneration from increase of revenue a moral certainty. Many are the places where the eye of an Engineer might detect desirable sites for drains and bunds; but few there are in comparison, where the Revenue Officer could see any prospect of a profitable return to Government.

Clearing out and improving the Ratraz Tank.

89. The most expensive project which has been contemplated during the past year, in connection with the subject of an increased supply of water, is that which has already been briefly alluded to in the 11th para. of this Report, viz. the clearing out and improvement of the Ratraz Tank. The attention of this Department has for some years past been directed to the advisability of removing the earth which has been gradually accumulating for the last half century in the bed of the tank; and a proposition was made by Lieut. Hart, while a Second Assistant in the Department, to make openings in the bund through which the mud, after having been stirred up by labourers, might be forcibly carried by the rush of water in the rains. This suggestion was fortunately objected to by the Honorable Court of Directors in their letter to Government of the 21st May 1844, and directions were given, that a very careful survey might be made of the nullah which supplies the tank, with the view of devising some remedy for the prevention of further accumulation in its bed. A most accurate survey was accordingly made by Captain Jacob, the place was carefully examined by both of us on more than one occasion, and the means of effecting the desired object were fully discussed; the result of which was, that an estimate was prepared and sent in to the Military Board on the 26th December last, accompanied by a survey and sections, for the excavation and removal of a mass of

earth whose solid contents amounted to 2,900,000 cubic feet, and for the re-opening of a channel and repair of a bund, which had been originally constructed with the intention of carrying off all earthy matter, and preventing any deposit in the tank, but which had fallen into complete neglect and disuse. The probable cost of these several improvements amounted to Rupees forty-six thousand seven hundred and sixty-five; and the additional quantity of water which Captain Jacob calculated would be available for the inhabitants of Poona, amounted to a 30 days' supply.

Rs. 46,765.

90. Another project of some importance which has engaged the attention of this Department is that which is alluded to in the 4th para. of the Superintending Engineer's Report for 1844 | 45, and which at that period was affording some employment in estimating and designing to the Executive Engineer of Nuggur. I mean the proposed aqueduct at Yeola, for the supply of the town with water. It appears that an estimate, amounting to Rupees twenty-nine thousand nine hundred and seventy-two, had been prepared by the Executive Engineer under date the 9th February 1846, but that the project had been temporarily abandoned in consequence of the inhabitants of the town evincing a disinclination to pay the amount of subscription originally agreed on by them. At the recommendation of the Revenue Commissioner, however, the project was revived by this Department, and it was intended that Captain Jacob should have been deputed to examine the locality, and prepare fresh estimates, if the proposed means of supply appeared likely to prove sufficient; but Captain Jacob's employment on the special duty already alluded to prevented this arrangement, and I contrived, therefore, during my tour of inspection, to visit Yeola and examine the place myself.

Proposed aqueduct at Yeola on the Nuggur and Malligaum Road.

Rs. 29,972.

91. The complaint regarding the scarcity of water I found to be but too well founded. The wells in the town and its immediate vicinity, which are the only available

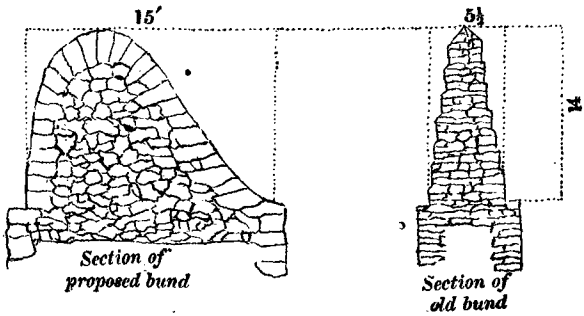
sources of supply, though numerous, are for the most part of little use, and many of them, even in the month of January, were perfectly dry. The Panmulla well, from which it was proposed to supply the town, and which is about half a mile distant from the walls, is the only favorable exception that can be pointed out; and as it is fortunately fed by a very strong spring, it yields a moderate supply to a great proportion of the towns-people during the hot weather. The depth of water at the time of my visit was eleven feet, and the rate of supply, on being carefully tested, was found to amount to 2,800 gallons per hour. This, though of course insufficient for all the inhabitants, would have yet been enough to fill some 3 or 4 reservoirs; and with a Persian wheel to raise the water, and masonry pipes to convey it to the town, the expense I think would have been very moderate compared to what the Executive Engineer of Nuggur had reckoned it at. The chief inhabitants, with whom I held some conversation on the subject, though evidently extremely anxious to avail themselves of any liberality the Government might be pleased to extend towards them, manifested a very great and extraordinary reluctance to bear any portion of the expense of thus adding to their own comforts; and as it appeared to me to be advisable, before estimating for the work, to ascertain from the proper quarter to what extent this disinclination might extend, reference was made to the Collector of Nuggur, under date the 23d February last, which to this day remains unreplied to. Nothing further, therefore, has been done.

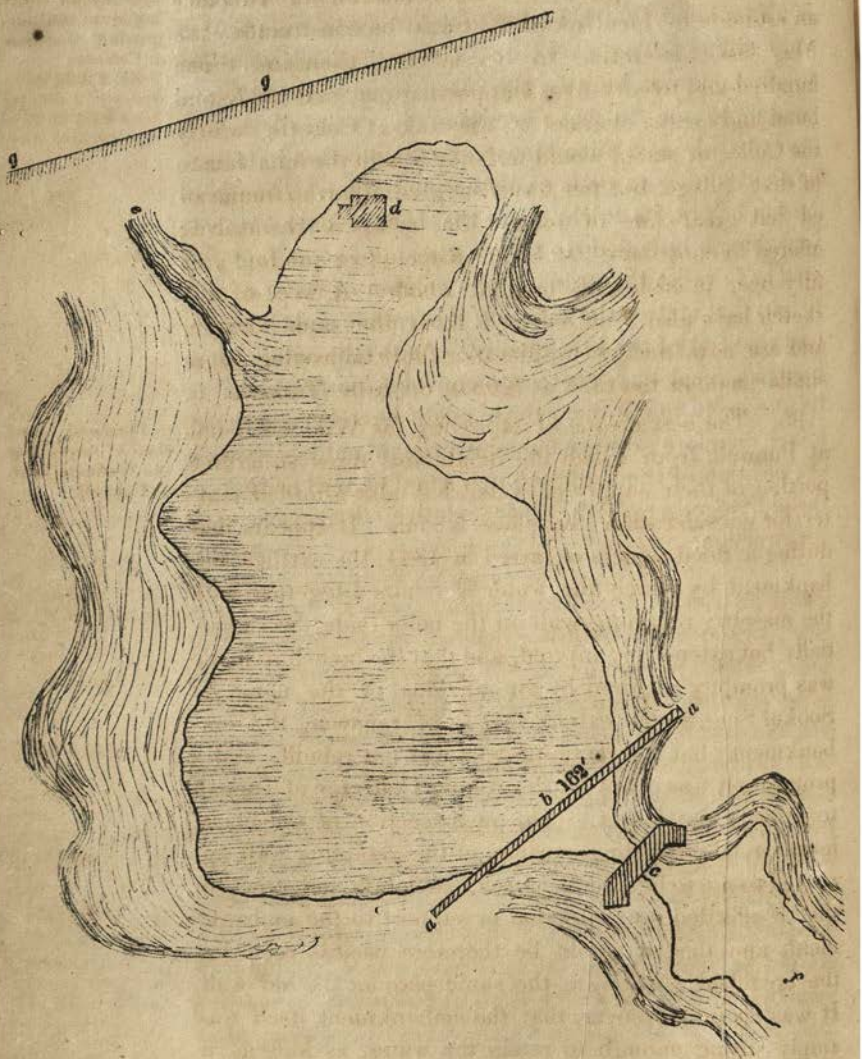
Projects for increasing the supply of water on Thull Ghaut Road.

92. Various projects have been under consideration for increasing the supply of water on the Thull Ghaut Road, and some I hope ere long will be sufficiently matured to be laid before Government and approved of. Without entering into particulars, I may mention that estimates are either in progress for proposed new works or improvement at Kussara, Kurdee, and Kullumgaom, or else that the necessary preliminary enquiries are being made with a view to the preparation of those documents with sufficient accuracy to be submitted to superior authority.

93. The work proposed at the last mentioned place is a new bund, which I think might be constructed at a very trifling outlay, and with a certainty of success. The original one was built by this Department in 1837, and appears to me to have been faultily designed, loosely constructed, and injudiciously placed, so that its failure so shortly afterwards is easily accounted for. Though 14 feet in height, its thickness at the base is only 5½ feet; and though intended to stem a stream of some force, as well as to resist the pressure of a column of water of the height first stated, the masonry is of rubble and choonam, and that not of the best quality. As to the site, I am unable, except by a sketch, to convey a correct idea of its inferiority to another which might have been selected, and I therefore add the subjoined rough outline, shewing the position of the proposed new bund as well as that of the old, together with their relative dimensions and construction.

Proposed new bund at Kullumgaom.





a. Old Bund.
b. Breach in do.
c. Proposed Bund.
d. Well.
e. Feeding Nullah.
f. Outlet.
g. Main Road.

94. At the requisition of the Collector of Tannah, an estimate by Lieutenant Scott was sent in on the 1st May last, amounting to Rupees two thousand three hundred and twenty-five, for clearing out, and adding a bund and escape channel to, the tank at Colsette, which the Collector stated would not only benefit the inhabitants of that village, but the travellers generally who frequented that great line of road. The villagers themselves offered to contribute the sum of Rupees two hundred and fifty-one, in cash and manual labour. A report and sketch have also been received from the same Officer, and are now under consideration, for improving in a similar manner the tank at Kulwa, opposite Tannah.

Estimate for clearing out and improving the tank at Colsette. Rs. 2,325.

Rs. 251.

95. The best means of improving the Wuddala Tank at Panwell, from which the inhabitants draw so large a portion of their supply of water, has also afforded matter for consideration and office labour. It appears that during a flood which occurred in 1844, the earthen embankment by which the water is retained together with the masonry retaining wall on the inner side, were partially but extensively injured, and that the breach so made was promptly repaired by an individual of the name of Sookul Sing, to the extent, that is, of renewing the embankment; but the retaining wall was not rebuilt, and a proposition was made by the Acting Collector of Tannah to remedy the defect. On an inspection of the place, however, the standing portion of the retaining wall appeared to me to be so deficient in foundation and strength, that it afforded no protection or support to the embankment, and that it would be therefore useless renewing the breached portion on the same plan as the old wall. It was clear, moreover, that the embankment itself was amply strong enough to retain the water, as long as it was not overflowed, and I proposed therefore to make escape channels, to give egress to the surplus water after it should have reached the level of the top of the retaining wall. The Military Board having approved of this

Proposed method of improving the Wuddala Tank at Panwell.

suggestion, an estimate has been called for, and is under preparation by Captain Pruen.

Large Tank at Tannah attempted to be cleared out; cause of ill success.

96. On the recommendation of the Judical Commissioner for Goozerat and the Concan, an attempt was made in the month of May of last year to clear out a large tank in Tannah which affords the chief supply of water to that town, and which had become choked up to a great extent with mud and weeds. As it was found to be a too expensive work to be done by free labour, I suggested that all the convicts who were then available from the Tannah Jail might be employed on it; and this proposition having been approved of by Government, Mr. Mungavin took out 250 prisoners on the 22nd of May, and commenced work. He had made, however, but four days' progress, when the convicts were withdrawn by order of the Acting Session Judge in consequence of a recommendation to that effect from the Civil Surgeon, and this exceedingly useful work was thus abandoned.

Chowdar Tank at Mhar cleared out.

97. The clearing out of the Chowdar Tank at Mhar, which was stated in last year's Report to have been postponed in consequence of the prevalence of cholera, has been this year satisfactorily completed by contract. The

Rs. 6,047.

accepted tender amounted to Rupees six thousand and forty-seven, but as the mud in the bed of the tank was found, after the water was drawn off, to be but 4½ feet in depth instead of 5½ as had been originally calculated on and estimated for, a corresponding deduction has been

Rs. 1,614.

made from that sum, so that there is an unexpended balance of Rupees one thousand six hundred and fourteen. This balance it is proposed to lay out in repairing certain portions of the retaining-wall which are in a dilapidated state.

Sluice gates constructed in the bund at Kullud.

98. The sluices which it was proposed to make in the bund across the Kuna at the village of Kullud, as mentioned in my Report for 1844 | 45, have been completed by Mr. Scott during the past season, at a cost of

Rs. 637.

Rupees six hundred and thirty-seven, the expense hav-

ing been defrayed partly by Mahadeo Rao Nilkunt Poorundurry Jagheerdar, and partly by the villagers.

New well at Egutpooree and improving a well at Shikrapoor.

99. A new well with cut stone retaining wall and stone parapet is under construction by Lieutenant Chapman at Egutpooree near the top of the Thull Ghaut, at an estimated cost of Rupees seven hundred and fifty-one; and as the site is well chosen, there is every prospect of its affording such an abundant supply of water, that, together with the excellent well which now exists, it will prevent any further complaints of scarcity at this constantly frequented halting place. A well is also being cleared out and improved by Mr. Scott at Shikrapoor, on the Seroor road, at an estimated cost of Rupees one hundred and seventy-six.

Rs. 751.

Rs. 176.

XVII. Building and Building Materials.

"Cheap work."

100. In my Report of last year, I ventured to offer a few remarks on the bad policy and false economy of resorting too generally to what is usually denominated "cheap work" on lines of communication intended to be permament, and I was in hopes that the examples therein cited of the comparative cost and durability of good work and "cheap work" might have the effect of bearing out my opinions.

Explanation of the term "good work" as relates to the Deccan.

101. As it is possible I may have been misunderstood, however, when I stated that "the better a work is constructed, the cheaper it will eventually prove," I now beg to explain, that I never intended the word "costlier" to be used synonymously with the word "better," and it was very far from my purpose to advocate the construction of ornamental or highly finished work. I merely wished to make it appear, that where the best of all known building material abounded, it was a great mistake not to take advantage of it; in other words, that where stone was to be had on the spot for the mere cost of quarrying, as it is in almost all parts of the Deccan, it was a pity to use wood, which has to be brought at an enormous expense from the Calicut or Dhang forests,

and a still greater pity to resort to rubble work, which, though cheaper at the outset than cut stone, possesses not a tenth of its durability.

Good work need not be costly, and it is in reality cheaper than bad.

102. The style of work whose general adoption on permanent lines of communication in the Deccan I respectfully contend for, is any thing but a costly one; in fact, it is not more expensive than those which I condemned. A good bridge of roughly cut or hammer dressed stone, chisel edged at the joints, would not cost more than a bridge of rubble and chunam abutments and piers, and teakwood superstructure: it would be beyond all comparison more lasting, and it would not require annual pointing and dammering and other repairs to prevent decay and dilapidation, as the other most assuredly would. With the material now advocated, therefore, abundant as it every where is in the Deccan, and easily prepared, I think I may venture to re-assert without fear of misapprehension, that "the better a work is constructed, the cheaper it will eventually prove."

Building materials should vary as the productions of a country vary.

103. Viewed in the light I intend, the rule might be made applicable to the products of all countries. In Goozerat for instance, where stone does not exist, and where brick and chunam are the most easily procurable of all building materials, and with a little trouble are generally to be had of good quality, I would construct all bridges, where a good foundation was to be had, of masonry so composed; and to carry out the rule I have laid down, I would invariably insist upon the work being of the *best* description, firmly believing that it would eventually prove the *cheapest*.

Instances of impolicy of "cheap work."

104. Of the sad impolicy of "cheap work," the Report I have now the honor to submit furnishes additional proof. The failure in 1840 of the bund at Kullumgaom, and its prototype at Kurroond, and the present failure of the approaches of the Shikrapoor Bridge and the small bridge near Nassick, are either solely or in part attributable to the fact of a very inferior description of work having con-

tented the designer or the builder; and to these instances I might add that of the parapet walls of a second bridge on the Mail road between the Sungum and Kirkee, which are in so dilapidated a state, that a heavy shower of rain would probably wash them away. Other works there are, of greater magnitude, which might be adduced as examples of the fault I complain of, but at present it comes not within my province to notice them.

XVIII. Department and Establishments.

European Subordinates. Removals and appointments.

105. Several changes have taken place amongst the European Overseers. Mr. Sub-Conductor Viges was remanded to his Corps in December last for the extreme negligence and untrustworthiness which he had manifested in the case of the Regimental Buildings at Nassick, as explained in the 81st paragraph of this Report; and Corporal Acting Sub-Assistant Overseer Godfrey was transferred to the Executive Engineer's Office at Poona in November, in order that he might be instructed in his duties.

106. Serjeant Assistant Overseer Brock was transferred from Lieutenant Mungavin's Office to that of Lieutenant Chapman in April 1846, and Corporal Sub-Assistant Overseer Tudor was also placed under the latter Officer for employment on the Thul Ghaut, in January of the present year. Corporal Sub-Assistant Overseer Mungavin rejoined the Department, after a temporary absence at Aden of eighteen months, in August of last year. Gunner Morgan of the Horse Artillery was admitted into the Department, and joined in October following, as an Acting Sub-Assistant Overseer; and Serjeant Assistant Overseer Roberts was also transferred to the Department, and placed under Captain Pruen's orders in March last. In consequence of these changes, the number of European Overseers now at the disposal of the Department exceeds by one the number available at the date of my last Report.

Promotions and conduct.

107. By the promotions in the Public Work Department which were published in Government General Orders of the fifteenth of February last, Serjeant Overseer Armitstead rose to the rank of Sub-Conductor, and Serjeants Levien and Brock, from Assistant Overseers to that of Overseers. On the conduct of the former, no further commendation need now be bestowed, as it was solely on account of his exemplary behaviour and superior qualifications that he was selected by the Military Board to fill the responsible situation in which he is at present placed, and to hold the rank he now does. Serjeant Levien is also well worthy of his promontion, and his steady conduct and high attainments as a draftsman give him claims to the favourable notice of his superiors. Of the rest of the European Overseers, Serjeants Tailor and Angus have most distinguished themselves by uniform excellence of behaviour and great attention to their duties, and Serjeant Brock is also favourably spoken of by Lieutenant Chapman.

Bad conduct of an Overseer.

108. The only Overseer whose conduct has been complained of is Serjeant Allyman, whose unfortunate addiction to intemperance has at last compelled Captain Pruen to solicit his removal; and his loss will be the less felt, as his acquirements are of so ordinary a kind as to be barely useful except in superintending road repairs and such like work.

Assistant Surveyors and Builders. Changes. Conduct.

109. The only changes which have been made amongst the Assistant Surveyors and Builders since the date of my last Report, are the departure of Hurbajee Rowjee to Aden, and the re-appointment of Govind Moreshwar to the Department, and the conduct of all the others has given satisfaction to the several Officers under whom they are placed. Venaik Bhicajee, as usual, has entitled himself to great praise for his invariable willingness and diligence, as well as for his qualifications, and Ragoba Hurjee has also maintained his previous good character.

110. That all of the Assistants have been diligently employed, either in carrying on sanctioned works or in estimating for proposed ones, will be fully credited, I trust, after a persual of the foregoing account, and an inspection of the appended list of estimates which have been submitted for consideration or sanction. And having now concluded my Report of the proceedings of the Department for the past official year, I am contented to hope that the satisfaction which Government were pleased to express at its performances of the preceding year, may be augmented in proportion to the increase of work which has been herein detailed.

I have the honor to be, &c.

(Signed) H. BERTHON, Captain,

Superintendent Roads and Tanks.

Poona, 4th August 1847.

STATEMENT of Expenditure in the Construction and Repair of Public Works in the Road and Tank Department from the 1st of May 1846 to the 30th of April 1847.

Names of Works.	Amount.			Total.
Works connected with the communication of the Country.	Rs.	*a.*	*p.*	
Constructing a bridge in the City of Poona	7,513	7	3	
Overseers Superintending .... ditto	183	13	2	
Annual repairs to Mail road, Poona to Khopoolie, for the official year 1845 | 46	6,762	14	10	
Annual repairs to cross roads .... ditto	235	10	8	
Ditto Bridges and Drains, Mail road ditto	740	0	0	
Special repairs to Moosee flying bridge	738	4	2	
Annual repairs to Poona and Moosee flying bridges, 46 | 47	378	0	0	
Ditto Mail road, Poona to Khopoolie..ditto	8,946	9	11	
Ditto Cross roads .....ditto .....ditto	3,935	0	0	
Ditto Fair weather roads.....ditto	155	0	0	
Ditto Bridges and Drains, Mail road...ditto	826	0	0	
Ditto Bridges and Drains, cross roads..ditto	18	0	0	
Special repairs to Bridges and Drains, Mail road..ditto	498	10	8	
Ditto Bridges and Drains, cross roads..ditto	220	0	0	
Rebuilding approaches and parapet walls of a bridge on the Mail road near the Sungum	533	1	11	
Minor Works	221	12	5	
Building stone coping to parapet walls of Poona bridge approaches	580	0	0	
Repairing Fords Poona Collectorate	13	8	4	
Constructing stone foundation to piece of road connecting Karlee bungalow with Mail road	66	0	9	
Annual repairs to Mail road Poona to Seroor for 1846 | 47	4,860	15	6	
Ditto Bridges and Drains on ditto.....ditto	424	3	4	
Ditto Main road Poona to Neera bridge ditto	2,646	9	8	
Ditto Bridges and Drains on ditto ....ditto	443	14	0	
Ditto Sholapoor road.....ditto	631	11	4	
Ditto Bridges and Drains on ditto ....ditto	20	1	3	
Ditto Cross roads.....ditto	413	11	8	
Ditto Bridges and Drains on ditto ....ditto	72	6	7	
Ditto Flying bridges at Seroor and Koregaum.....ditto	700	0	0	
Ditto Cleared tracks.....ditto	283	3	8	
Ditto Bridges and Drains on ditto .....ditto	48	7	2	
Repairing approach of Shikrapore bridge	309	0	4	
Minor Works	151	5	11	
Making four brass sheaved blocks for flying bridges	116	0	0	
Building Bridge over a nullah at Wusudwadee	1,720	0	0	
Ditto.....ditto..... at Kondapoor	2,940	0	0	
Constructing a new road between Patus and Indapoor	1,25,721	3	0	
Carried forward Rs....	1,74,068	11	6	

Statement.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.
	Rs.	a.	p.	
Brought over Rs....	1,74,068	11	6	
Annual repairs to Main road Seroor to Nuggur 46 | 47....	3,362	9	10	
Ditto Bridge and Drains ditto .....ditto....	447	13	0	
Ditto Cross roads.....ditto....	737	2	10	
Ditto Bridges and Drains.....ditto....	73	12	2	
Minor Works.....	24	2	2	
Annual repairs to works on Nagpore Dak line.....	5,841	3	4	
Special repairs to..... ditto .....ditto.....	1,733	7	7	
Erection of New Works ditto .....ditto.....	1,660	5	2	
Maintenance of Ferrymen and Haulers ditto.....	3,092	1	1	
Taking charge of stores..... ditto.....	240	0	0	
Annual repairs to Main road from Thull to Candore Ghaut..... 1846 | 47..	12,936	2	7	
Annual repairs to Bridges and Drains ....ditto	178	15	11	
Ditto Cross roads Nassick Sub-Collectorate....	1,639	13	5	
Ditto Bridges and Drains ditto....ditto	83	6	7	
Ditto Ferry boats and Flying bridges.....	162	14	7	
Special repairs to Main road.....	23	14	10	
Converting Kadoo ferry boat into a flying bridge.....	54	15	7	
Repairing a Bridge on Sinnur cross road....	296	15	5	
Minor Works.....	.....	..	..	
Pulling down and stacking frame work of the Undwell Bridge.....	85	6	2	
Completing lower and experimental portions of road on the Thull Ghaut.....	16,691	11	9	
Ditto upper portion ..... ditto	6,702	0	11	
Special repairs to Main road, Colsette ferry to Thull Ghaut.	89	0	7	
Annual repairs to ditto ditto.....1846 | 47..	9,070	10	4	
Repairing Bridge at Gokhirwa.....	5,305	9	11	
Minor Works.....	18	12	0	
Constructing steps to Jetty at Callian.....	43	3	6	
Repairs to Bridge at Bassein.....	102	14	5	
Annual repairs to roads in Bhewndy 1846 | 47.....	134	6	8	
Special repairs to Kusseylee bunder (called erroneously in last year's Report, owing to a mistake of the copyist, "Callian Pier").....	1,006	7	6	
Conveying four guns from Tannah to Kusseylee bunder....	21	0	0	
Repairing road from Anick to Chemboor.....	115	4	5	
Building a Boat for Oomergaom ferry.....	421	10	1	
Breaking down and re-building wing walls of Mullar Bridge	404	7	0	
Constructing four roller frames.....	120	0	0	
Annual repairs to main road, Sion to Colsette, 1846 | 47....	5,042	15	9	
Ditto ditto Bandora to Ghorebunder ditto....	5,695	0	0	
Ditto ditto Trombay to Sion..... ditto.....	993	7	0	
Special Ditto to ditto between Tannah and Perseek.....	51	0	2	
Minor Works.....	45	4	5	
Annual repairs to road from Chemboor to Mhoul.....	165	0	0	
Special repairs to Sankie bridge and Vehar bund.....	16	5	2	
Removing guns from the ramps of the Tannah Causeway and substituting mooring rings.....	152	11	6	
Erecting a bridge at Erla Parla.....	1,500	0	0	
Constructing new road from Coorla to Bhandoop by convict labour.....	7,500	0	0	
Carried forward Rs....	2,68,152	12	10	

Statement.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs.....	2,68,152	12	10			
Providing metal for the Mail road from Panwell to Khoopoolie out of the sanction for 1845 | 46.....	145	15	7			
Annual repairs to Nagotna and Mahableshwur road ditto..	3,025	0	0			
Repairing Platform of Panwell bunder.....	4,342	8	8			
Annual repairs to Mail road, 1846 | 47.....	5,973	7	1			
Ditto Bridges and Drains..... ditto..	91	10	8			
Ditto Nagotna and Mahableshwur road..ditto..	4,670	0	0			
Ditto Cross roads Tannah Collectorate ..ditto..	3,357	13	2			
Constructing a piece of road leading into the Town of Chiploon.....	1,439	0	0			
Annual repairs to Cross roads Southern Concan, 46 | 47..	1,169	1	5			
				292,367	5	8
TANKS, WELLS, AND BUNDS.						
Deepening Wells at Wursoolie.....	16	4	4			
Building coping of cut stone to two wells in the Khundalla Tank.....	551	9	0			
Opening sluice gates in the Dhurrum at Kullud.....	637	15	10			
Opening sluice gates of Kutrass Tank.....	6	0	0			
Closing..... ditto..... ditto	47	0	0			
Repairs to wells, Nassick Sub-Collectorate.....	34	7	11			
Deepening and enlarging well at Kussara.....	221	12	10			
Improving the Tank at..... ditto	109	15	7			
Clearing Tank in the Town of Tannah.....	9	5	6			
Clearing out Chowdar Tank at Mhar.....	4,355	0	0			
				5,989	7	6
BUILDINGS.						
Annual and special repairs to Travellers' Bungalows and Furniture, for 1846 | 47.....	4,145	12	3			
Building a Post Office at Khundalla.....	286	0	0			
Supplying plank weather frames to Karlee and Wurgaon bungalows and out-houses.....	113	4	5			
Building a Privy at Neera Bridge bungalow.....	171	0	0			
Repairs to roof of Seroor Bungalow.....	37	3	2			
Repairs to ditto of Chandore bungalow out-houses.....	20	14	0			
Erecting Military Buildings at Nassick.....	3,852	4	8			
Certain additions to.... ditto....ditto.....	497	7	10			
Annual repairs to store room at Bhewndy.....	9	2	9			
Ditto Military Buildings ditto.....	6	9	0			
Special repairs to Tannah Church.....	9	11	10			
White-washing Kospital at Bhewndy.....	34	5	6			
Annual repairs to buildings in Customs Department at Tannah.....	165	4	1			
Special repairs to..... ditto..... ditto.....	10	4	0			
Constructing a gate and repairing enclosure wells of Mamlutdar's Cutcherry at Callian.....	258	3	1			
Annual repairs to Civil and Detacht. Hospl. at Tannah....	90	15	3			
Ditto Store room..... ditto.....	42	0	0			
Weather Screens for entrance to Tannah Church.....	93	7	0			
Special repairs to Office of Collector of Customs Tannah..	40	7	3			
Annual repairs to permanent and temporary pendalls.....	117	9	6			
Carried forward Rs.....	10,001	13	7	2,98,356	12	5

Statement.—(Continued.)

Names of Works.	Amount.			Total.		
	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*
Brought over Rs....	10,001	13	7	2,98,356	12	5
Erecting four new and improving two old ditto.....	3,470	7	8			
Constructing three Sentry boxes.....	24	15	8			
Erecting a new Detachment Hospital.....	1,500	0	0			
Constructing a new Bungalow at Par.....	1,250	0	0			
Furniture for.....ditto.....	90	0	0			
Numda Ceiling to Indapoor Bungalow.....	101	11	11			
				16,439	0	10
Grand total, Three Lacs, fourteen thousand, seven hundred and ninety-five, thirteen annas, and three pies.....				3,14,795	13	3

STATEMENT shewing the Amount expended by each Officer of the Road and Tank Department from the 1st of May 1846 to the 30th April 1847.

Names of Officers.	Roads and Bridges.			Tanks, Wells and Bunds.			Buildings.			Total.		
	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*	Rs.	*a.*	*p.*
Lieutenant Cowper.....	32,565	14	1	567	13	4	1,581	7	7	34,715	3	0
Mr. Scott.....	20,427	2	5	690	15	10	1,972	2	10	23,090	5	1
Mr. Armitstead.....	1,25,721	3	0	.....	..	..	.....	..	..	1,25,721	3	0
Captain Dennis.....	12,567	1	2	.....	..	..	.....	..	..	12,567	1	2
Lieutenant Chapman.....	38,856	5	9	34	7	11	4,985	10	9	43,876	8	5
„ Scott.....	15,792	0	11	331	12	5	919	7	7	17,043	4	11
„ Mungavin.....	22,223	1	6	9	5	6	5,471	14	4	27,704	5	4
Captain Pruen.....	24,214	8	7	4,355	0	0	1,508	5	9	30,077	14	4
Total.....	2,92,367	5	5	5,989	7	0	16,439	0	10	3,14,795	13	3

RETURN shewing the Expense of Engineering and Superintendence with reference to actual outlay.

Names of Officers.	Expense of Establishment per annum.	Expenditure.	Rate per cent.
	Rs.	Rs.	
Lieutenant Cowper	8,048	34,715	23 1/4
Mr. Scott	9,047	23,090	39 1/5
Mr. Armitstead	1,576	1,25,721	1 1/4
Captain Dennis	7,140	12,567	* 56 4/5
Lieutenant Chapman	7,805	43,876	17 4/5
„ Scott	8,859	17,043	52
„ Mungavin	7,773	27,704	28
Captain Pruen	8,415	30,077	28

Total Expenditure during the year ..... Rs. 3,14,795
Cost of Establishments ..... do ..... „ 58,663
Average rate per cent 18 5/8

(Signed) H. BERTHON, Captain,
Supt. Roads &c.

Note.—Captain Dennis is Post Master as well as in charge of the Nagpoor Dak Line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his engineering duties are confined to one line of works.

(Signed) H. BERTHON, Captain,
Superintendent Roads, &c.

List of Estimates prepared by the Officers of the Road and Tank Department, and submitted for sanction between the 1st of May 1846 and the 30th of April 1847.

Estimates.	Amount.		
	Rs.	*a.*	*p.*
CAPTAIN JACOB.			
Estimate for a new Terminus to the Poona and Panwell Mail road, accompanied by a survey, sections, and 11 designs	2,55,592	0	0
Supplementary estimate for certain alterations to ditto	9,947	0	0
Estimate for clearing out and improving the Tank at Kutraj, accompanied by a survey and sections	46,765	0	0
LIEUTENANT NORTH.			
Rough estimate for a new line of road between Kussara and Kurdee, accompanied by a survey and sections	1,33,391	0	0
LIEUTENANT BRUCE.			
Estimate for a new line of road between Poona and Wagoolie, accompanied by a survey, sections, and 22 designs	88,986	0	0
LIEUTENANT COWPER.			
Estimate for a coping to the approaches of the Poona bridge	580	0	0
Ditto ....for re-building approaches and parapets of a bridge on the Mail road, accompanied by a plan	1,060	0	0
Estimate for supplying plank weather frames to Karlee and Wargaon Travellers' bungalows and out-houses	120	0	0
Estimate for constructing a piece of road to connect the Karlee bungalow with the Mail road	195	0	0
Estimate for securing railing posts of Wellesley bridge	216	0	0
Estimate for 53 Drains and Culverts on Bombay road, accompanied by plans.	31,224	0	0
Mr. SCOTT.			
Supplementary estimate for construction of Toka raft	424	0	0
Estimate for repairing retaining wall of Shicrapore bridge	460	0	0
Ditto for removing the Poona flying bridge, and establishing it at Kurradee, accompanied by a section of the river, plan &c.	2,493	0	0
Mr. SUB-CONDUCTOR ARMITSTEAD.			
Estimate for completing the new road between Patus and Indapoor, accompanied by a survey, section, and numerous designs	1,31,643	0	0
LIEUTENANT CHAPMAN.			
Estimate for a well at Egutpoora, accompanied by a plan	751	0	0
Ditto for additions and alterations to Military buildings at Nassick, accompanied by plans	915	0	0
Carried forward Rs.	7,04,762	0	0

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ESTIMATES.	AMOUNT.		
LIEUTENANT CHAPMAN.—*(Continued.)*	Rs.	*a.*	*p.*
Brought over Rs.....	7,04,762	0	0
Estimate for repairing a bridge on Sinnur cross road, accompanied by a plan.	297	0	0
Ditto for completing new road on the Thull Ghaut, with several designs.	1,48,391	0	0
Ditto for improving the main road at Kokungaom.....	258	0	0
LIEUTENANT SCOTT.			
Estimate for a weighing shed for the Tannah Custom House, accompanied by a plan.....	770	0	0
Estimate for repairing Mamlutdar's Cutcherry at Callian.....	260	0	0
Ditto for constructing stairs to the Callian setty, accompanied by plan..	49	0	0
Estimate for a bungalow for the Assistant Collector at Kelwa Mahim, accompanied by a plan.....	4,914	0	0
Estimate for a bungalow for the Assistant Collector of Customs at Bassein...	5,400	0	0
Estimate for building a well at Bhewndy.....	135	0	0
Ditto for removing rubbish from gutters of Ruttoonda pass.....	99	0	0
Ditto for clearing out and improving the tank at Colsette, with plan &c..	2,325	0	0
LIEUTENANT MUNGAVIN.			
Estimate for a Bridge at Erla Parla, accompanied by a plan.....	5,310	0	0
Ditto for an Hospital at Tanna.... ditto..... ditto.....	4,569	0	0
CAPTAIN PRUEN.			
Estimate for a numda ceiling to Indapoor Travellers' bungalow.....	103	0	0
Ditto for a Mamlutdar's Cutcherry at Oorun, accompanied by a plan....	1,367	0	0
CAPTAIN DENNIS.			
Estimate for a suspension Bridge over a nullah on the Nagpoor Dak Line, accompanied by a plan.....	767	0	0
ANNUAL REPAIRS.			
Estimates for annual repairs to roads for the year 1847 | 48.....	97,060	0	0
Ditto for .....ditto..to Bungalows &c.....	4,878	0	0
Grand Total....	9,81,714	0	0

(Signed) H. BERTHON, Captain,
Superintendent Roads &c.